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ABSTRACT

This curriculum guide contains 28 competency-based units of study for use in high school agricultural mechanics courses, especially in Connecticut. The 10 exploratory units, suitable for grades 9-10, cover the following topics: beginning welding; cold metal and soldering; electricity; plumbing; power tools; shop safety, mathematics, painting and glazing; small engines, basic care and operation; tool sharpening and fitting; tractor operation; and woodworking and sketching and drawing. The 18 specialized units, suitable for grades 11-12, cover advanced agricultural welding; agricultural machinery repair and maintenance; agricultural structures; agricultural waste management; agricultural waste management; alternate energy; concrete for farm and home use; diesel fuel systems; electric motors and controls; fencing; field machines; hydraulic; new equipment assembly; power trains and transmissions; private water supplies and septic systems; small gasoline engines repair and overhaul; tractor engine overhaul; and tractor maintenance. Each unit contains objectives, related job titles and relevant competencies, content outline, teacher activities, student activities; evaluation, resources, bibliography, and teacher unit review. (KC)

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REVISING AND UPDATING THE AGRICULTURAL MECHANICS
COMPONENTS OF THE CONNECTICUT
VOCATIONAL AGRICULTURE CURRICULUM

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June, 1989

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PREFACE

This printing of the Agricultural Mechanics components of the suggested Connecticut Vocational Agriculture Curriculum has been designed for use in the Connecticut Regional Vocational Agriculture Centers. These centers are multi-staffed with three or more teachers of Vocational Agriculture who have each developed an expertise in one or more of the major areas of agriculture. The curriculum is based on the following major areas of agriculture: Animal Science, Plant Science, Agriculture Mechanics, Natural Resources and Aquaculture.

This printing includes an emphasis on technology within the Agricultural Mechanics Curriculum. It is a reflection of the ever-changing field of Agricultural Mechanics in Connecticut.

A full program of Vocational Agriculture is based on four years of enrollment. The student would, in the first two years, be enrolled in exploratory units of study covering all four major areas of study. Development of fundamental skills would be stressed during the exploratory units.

The third and fourth year of enrollment would be made up of an election of units designed to best prepare the individual student to meet his or her vocational objective in agriculture.

Students enrolled in the program will be involved in areas of study common to all of agriculture. These areas include career awareness, agricultural business management, leadership development through involvement in the FFA chapter and the practical application of units studied through involvement with the supervised agricultural experience program.

This revision includes the integration of a new section in each unit of instruction entitled, "Related Job Titles and Relevant Competencies" for Agricultural Mechanics. The section is designed to highlight for teachers and students the potential employment or entrepreneurship job titles and relevant competencies needed for employment or self-employment success. The job titles and relevant competencies were identified and validated in the National Agriculture Occupations Competency Study and are included as an integral part of the curriculum.

The curriculum is organized and color coded for ease of use. The Agricultural Mechanics Units are printed on blue paper. The introductory material and Related Job Titles and Competencies are printed on white paper. The page numbers on the units of instruction are coded as follows:

- EM - Exploratory Agricultural Mechanics
- SM - Specialized Agricultural Mechanics

Exploratory units are generally appropriate for students in the ninth and tenth grades, while specialized units are designed for students in grades eleven and twelve.

The Related Job Titles and Relevant Competencies have two page numbers. They are numbered consecutively at the top. The number at the bottom refers to the page number in the National Agriculture Occupations Competency Study. This page number is maintained for easy reference to the original document.

The organization for sequence of instruction will be at the discretion of certified teachers, administration, and consulting committee members in each center in accordance with availability of staff and facilities. The primary objective is to serve the individual interests and needs of the students.

The original development of the Agricultural Mechanics Component of this curriculum involved the cumulative efforts of the staff of Agricultural Mechanics teachers in Connecticut Regional Vocational Agriculture Centers. Teachers authored the units of study. Each unit was pilot tested by a teacher other than the author. Editing to produce a common format has been done by the teachers. It has not been possible to bring into this revised curriculum all of the information which is available. However, teachers are encouraged to use the curriculum as their basic teaching document and to supplement and enrich the curriculum as appropriate. It is intended that as additional information becomes available to teachers while using this curriculum, such information will be entered into the individual teacher's copy on the new unit evaluation form, for use in future curriculum revisions.

The Related Job Titles and Relevant Competencies were identified for each unit of instruction. Much time and effort was spent on identifying those validated activities needed by employed workers to help ensure that the curriculum is competency-based.

ACKNOWLEDGMENTS

The Project Director and Project Assistant wish to express their appreciation to those who have contributed to the success and completion of the curriculum. Mark Burdick, Vernon Cleaves, Richard Dexter, Dan Digiulio, Allan Fenner, Scott Hendricks, Philip Hoyt, William Morehouse, Stan Pullen, Dale Schutt, Mike Sibiga and Alex Thompson contributed to the revision of specific units.

A sincere thank you is extended to the curriculum writers for their conscientious efforts throughout the project. Special recognition is due to Dr. David Calchera, Paula Colen and Ginny Garnder, EASTCONN, whose knowledge of project grant procedures and expert skills made the completion of the project possible.

Special appreciation is extended to Mr. Roger Lawrence, State Consultant, Vocational Agriculture, Mr. Milton Natusch, FFA Executive Secretary, Dr. Valerie Pichanick, Project Officer and Mr. Charles Bertagna, Chief, Bureau of Vocational Services, for their involvement in the initiation and direction of the study. We would also like to extend our gratitude to Rosemarie Bohuslaw for her efficiency and expertise in entering the curriculum on the word processor. Her efforts will make future revisions of the curriculum much easier.

Finally, to the teachers of vocational agriculture in Connecticut, for whom this curriculum is designed to serve, appreciation is extended for their cooperation in providing input and support throughout the study.

Dr. Alfred J. Mannebach
Project Director

David M. Provoncha
Project Assistant

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RELATED JOB TITLES AND RELEVANT COMPETENCIES

Production Agriculture Mechanic	288*	1
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* This column contains the original document page number

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Beginning Welding

LENGTH: One - three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 9 or 10

OBJECTIVES: The students will be able to:

1. Demonstrate safe welding practices.
2. Safely operate the power grinder, power hacksaw, drill press and metal-working hand tools.
3. Properly and safely care for welding equipment and supplies.
4. Identify basic metal-working tools.
5. Identify common metals.
6. Select the best type of welding equipment with respect to the job to be done.
7. Select the proper type of electrode, or filler rod for the job to be done.
8. Make correct electric arc welds in mild steel.
9. Make correct oxyacetylene welds in mild steel.
10. Determine quality and strength of weld.
11. Properly braze sheet metal.
12. Cut a hole in mild steel with the oxyacetylene cutting torch.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288:3(a), 289:3(b-f), 289:6(a-m), 290:4(a-u)
Plant Maintenance Mechanic	357:1(a-h), 358:2(l, m, n, r, w), 358:3(a-e, h, i)

CONTENT:

I. Safety

- A. eye protection needed
- B. body protection, including hands and face
- C. fire extinguishers and how to use them
- D. fire blanket and use
- E. safe operation of power grinder, power hacksaw, drill press and metal working hand tools

II. Selecting electrodes

- A. type of welder
- B. kind of metal
- C. thickness of metal
- D. position of joint

III. Striking an arc

- A. scratching
- B. tapping

IV. Running a bead

- A. tilt electrode in line of travel
- B. clean metal between beads
- C. cooling for strength
- D. evaluate weld

V. Kinds of welds

- A. butt
- B. lap
- C. fillet
- D. edge
- E. corner

VI. Welding with oxyacetylene

- A. safe set-up of equipment and use
- B. adjusting flame for welding and cutting
- C. correct torch angles

VII. Brazing

- A. select pressures and tip
- B. use of oxydizing flame
- C. using bronze rod and flux

TEACHER ACTIVITIES:

1. Discuss types of welders and safe proper operation of equipment.
2. Demonstrate:
 - A. Safety practices
 - B. ways to strike an arc
 - C. running a bead
 - D. setting up oxyacetylene equipment
 - E. flame adjustments
 - F. cutting
 - G. welding with oxyacetylene
 - H. brazing with oxyacetylene
 - I. safe operation of power grinder, power hacksaw, drill press and hand tools

3. Hand out prepared directions for each exercise.
4. Observe and supervise student activities.
5. Evaluate students' projects.
6. Secure materials to work with.

STUDENT ACTIVITIES:

1. Follow all safety practices.
2. Complete exercise assigned.
3. Practice:
 - A. running a bead
 - B. padding
 - C. welding two pieces of metal together
 - D. lighting a welding torch
 - E. running a fusion weld
 - F. welding two pieces of metal together with oxyacetylene and filler rod
 - G. brazing two pieces of metal together
4. Maintain a notebook of notes and reference materials handed out.

EVALUATION:

1. Score sheets for each exercise.
2. Written quizzes and exams.
3. Evaluate notebook.
4. Examples of good welds, cutting, brazing.

RESOURCES:

1. School supplied materials
2. Work sheets
3. Text books
4. Examples of good welds, cutting, brazing

BIBLIOGRAPHY:

References:

Arc Welding, The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio

Elmer L. Cooper, Agriculture Mechanics: Fundamentals and Applications, Delmar Publishers, Marketing Services, 2 Computer Drive West, Box 15015, Albany, New York (instructors guide)

Larry Jeffus, Safety for Welders. Delmar Publishers, Marketing Services, 2 Computer Drive West, Box 15015, Albany New York (instructors guide)

I.H. Griffin, E.M. Roden & C.W. Briggs, Basic Arc Welding, 4th Ed., Delmar Publishers, Marketing Services, 2 Computer Drive West, Box 15015, Albany, New York (instructors guide)

Phipps, Lloyd J, Farm Mechanics Text and Handbook, The Interstate Publishing Co., Danville, Illinois

Seeber, Glen & Allen, Ray, Oxyacetylene Welding, California State Polytechnical College.

Sossin, H.A., Arc Welding Instructions for Beginners, The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio 44117.

Larry Jeffus & Harold V. Johnson, Welding: Principles and Applications, 2nd Ed., 1988, Delmar Publishers, Marketing Services, 2 Computer Drive West, Box 15015, Albany, New York (instructors guide)

I.H. Griffin, E.M. Roden & C.W. Briggs, Basic Oxyacetylene Welding 4th Ed., Delmar Publishers, Marketing Services, 2 Computer Drive West, Box 15015, Albany, New York (instructors guide)

MEDIA:

Basic Arc Welding Safety (video), Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407

Welding Equipment Safety and Operations (computer; IBM, Apple, TRS-80) SHOPWARE EDUCATIONAL SERVICES, Department PW-2, Route 1, Box 330-E, Aberdeen, WA 98520-9984

Arc & Oxy=acetylene Welding (videos), Video Trend, P.O. Box 524, St. George, UT 84770, (801) 673-1601

INDIVIDUAL TEACHER UNIT REVIEW

This addition to the Curriculum Guide is included after each unit. After teaching this unit of instruction, please complete the form below. It is intended to be used by curriculum writers the next time this curriculum undergoes revision. It is also intended for your use as an aid in periodic updating as you continually teach this unit.

A. ADDITIONAL AND UPDATED TEACHING METHODS:

1. Student Activities --

2. Teacher Activities --

3. Evaluation Methods -

B. ADDITIONAL AND UPDATED REFERENCES:

1. Media -

2. Bibliography -

C. ADDITIONAL AND UPDATED RESOURCES INCLUDING ADDRESSES AND PHONE NUMBERS:

1. Resources	Address	Phone
--------------	---------	-------

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Cold Metal and Soldering

LENGTH: One - four weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 9 or 10

OBJECTIVES: The students will be able to:

1. Safely operate the power grinder, power hacksaw, drill press and metal-working hand tools.
2. Identify basic metal-working tools.
3. Identify common metals.
4. Use a tap and die, drill charts.
5. Use tap and die, calipers; micrometers, rulers, scribes, and screw pitch gauge.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic 290:8(a-n), 291:8(o-r), 294:8(j)

CONTENT:

I. Safety

- A. eye protection needed
- B. body protection, including hands and face
- C. safe operating procedures for power and hand tools to be used
- D. safe use of acid fluxes

II. Nut and bolt threading

- A. select round iron
- B. prepare round iron for using a die
- C. cut threads with a die
- D. select hand iron for a nut, mark center, and center punch, select correct drill size and thread
- E. select tap and die
- F. clean-up when done

III. Soldering

- A. cut metal
- B. prepare for solder
- C. using flux properly
- D. heat and apply solder
- E. clean up

TEACHER ACTIVITIES:

1. Review safety with students.
2. Hand out prepared directions for each exercise.
3. Demonstrate:
 - A. use of chart for tap and die
 - B. use of drill, tap and die
 - C. use of measuring tools
 - D. use of a template
 - E. measuring stock
 - F. safe use of power tools.
4. Observe and supervise student activities.
5. Evaluate students' projects.

STUDENT ACTIVITIES:

1. Follow all safety practices.
2. Complete exercise assigned.
3. Maintain a notebook of notes and reference materials handed out.

EVALUATION:

1. Score sheets for each exercise.
2. Written quizzes and exams.
3. Evaluate notebooks.
4. Follow-up evaluation of students' projects.

RESOURCES:

1. School supplied materials.
2. Works sheets.
3. Text books.

BIBLIOGRAPHY:

Elmer L. Cooper, Agriculture Mechanics: Fundamental and Applications, Delmar Publishers, Marketing Services, 2 Computer Drive West, Box 15015, Albany, New York (instructors guide)

Roehl and Longhouse, Farmers Shop Book, Bruce Publishing Co., 1953.

Phipps, Lloyd J., Farm Mechanics Text and Handbook, The Interstate Publishing Co., Danville, Illinois

INDIVIDUAL TEACHER UNIT REVIEW

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1. Student Activities --

2. Teacher Activities --

3. Evaluation Methods -

B. ADDITIONAL AND UPDATED REFERENCES:

1. Media -

2. Bibliography -

C. ADDITIONAL AND UPDATED RESOURCES INCLUDING ADDRESSES AND PHONE NUMBERS:

1. Resources

Address

Phone

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Electricity

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 9 or 10

OBJECTIVES: The students will be able to:

1. Demonstrate safe practices to be used when working with electricity.
2. Define electrical terms.
3. State generation and magnetism principles.
4. Construct and follow simple wiring diagrams.
5. Identify and select electrical materials.
6. Determine wire sizes.
7. Use voltage drop charts.
8. Determine proper fuse size.
9. Wire plugs, switches and receptacles.
10. Compute an electrical bill.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Setup Mechanic of Farm	298:1(e), 301:7(h)
Industrial Equipment	291:10(f, g, i, l, m), 291-292:11(a,
Production Agriculture Mechanic	b, c, e, h, l, m, n, o, p, s, v),
	293:14(j, l), 294:18 (a-p), 295:19(a-h)
Plant Maintenance Mechanic	357:2(j)
Instrument Technician	353:1(a-e), 353:2(b, d, e, f, g, h, i,
	j, n, o, p, q) 354:3(a-f)
Plant Electrician	349-350(all)

CONTENT:

I. Safety

- A. proper use of safety glasses
- B. correct electrical code procedures
- C. ground fault interrupters
- D. safety devices on equipment
- E. circuit breaker and fuse box safety
- F. care of electrical shock victims
- G. Use of ladders

- II. Electrical safety
 - A. national electrical code
 - B. underwriters lab
 - C. grounding
- III. Define terms: A.C., D.C., generation, amp, volt, watt, kilowatt, cycle, phase, ohm, transformer, circuit, series and parallel circuits
- IV. Electrical principles
 - A. generation
 - B. transmission
 - C. distribution
- V. Wiring diagrams
 - A. symbols
 - B. interpret schematic
 - C. construction of schematic
- VI. Selection and identification of wiring materials
 - A. wire types and sizes
 - B. safety devices
 - C. switches
 - D. receptacles
 - E. tools
- VII. Fusing and wire sizes
 - A. circuits
 - B. voltage drop charts
- VIII. Electrical skills
 - A. reading a meter
 - B. computing an electrical bill
 - C. wiring switches, boxes, outlets and plugs
 - D. running simple circuits

TEACHER ACTIVITIES:

1. Present safety rules and procedures.
2. Present electrical terms.
3. Demonstrate electrical materials and equipment.
4. Present procedures how to calculate wattage, volts, amps, ohms, fuse size, wire size, voltage drop, kilowatts, kilowatt hours, and power costs.
5. Demonstrate electrical terms by using wiring boards.

6. Demonstrate how to make connections, splices, wiring switches, outlets and plugs.
7. Field trip to an electrical shop and/or power plant.
8. Observe and supervise student activities to insure proper skill development.

STUDENT ACTIVITIES:

1. Keep a notebook of handout materials and class notes.
2. Define electrical terms.
3. Identify electrical materials and tools.
4. Demonstrate procedures.
5. Read wire charts.
6. Read a meter and compute monthly costs.
7. Draw, read and wire circuits from a schematic.
8. Complete class handouts.
9. Participate in classroom discussion.

EVALUATION:

1. Notebook organization and materials completed.
2. Tests and quizzes on skills developed.
3. Lab sheets evaluated.
4. Students skill development monitored.
5. Practical shop skills tested.

RESOURCES:

1. Shop and equipment.
2. Wiring boards.
3. Electrical tools.

4. Hobar Publications, Inc., 1234 Tiller Road, St. Paul, MN 55112

a. Wiring Practices Panel

1. includes:

- a. circuit breaker or fuse
- b. octagon boxes
- c. grounded duplex receptacle
- d. cover plates
- e. grounded plug cap
- f. grounding clips
- g. bx cable
- h. lamp holder
- i. switch boxes
- j. 3-way switches
- k. 4-way switches
- l. box connectors
- m. wire nut connectors
- n. romex cable
- o. safety switch

b. Electrical Tool Kit

1. includes:

- a. electrical tester
- b. cable nippers
- c. diagonal cutters
- d. long chain nose pliers
- e. wire strippers
- f. linesman pliers
- g. screwdrivers

c. Power Cord Project

1. includes:

- a. 14/3 power cord
- b. box clamps
- c. duplex receptacle
- d. deadfront plug cap
- e. solderless connectors
- f. boxes
- g. ssu fuseholder switch
- h. cover plate
- i. single conductor
- j. plans

5. Electrical meters

6. Power company

BIBLIOGRAPHY:

References:

1. Hobar Publications, Inc., 1234 Tiller Road, St. Paul, MN 55112
 - a. Agricultural Wiring Handbook - 1987 - Electrical terms, general wiring requirements for dairy, poultry and other agricultural operations.
 - b. Basic Electricity and Practical Wiring - 65 page manual - 1977 Edition - Circuits, measuring electric power and costs, use and current protection, switching, grounding for safety, service entrance and transmission and distribution of electricity.
 - c. Basic Electricity Worksheet - 20 sheets covering basic principles of electricity from connecting electrical motors, making solderless connections to connecting 3-way switches.
 - d. Electrical and Basic Controls used in Agricultural Production - 5 basic lessons - switches and circuits, relay devices, motor control devices and automatic sensing devices.
 - e. Electrical Wiring - 65 page manual - an instructors manual including demonstrations - 3rd Edition 1985
 - f. Electrical Wiring - 10 units on simplified wiring procedures. Includes units on safety and equipment for disadvantaged and handicapped students.
 - g. National Electrical Code 1987
 - h. Understanding Electricity & Electrical Terms, AAVIM, 6th Edition
2. Instructional Media Service, 24 Roberts Hall, Cornell University, Ithaca, NY 14853-5901
 - M813 - Electrical Safety (1 page)
 - M503 - Electrical Wire Procedures (28 pages)
3. McKenzie, Bruce and Gerald Zachariah, Understanding and Using Electricity. Interstate Publishers, P.O. Box 50, Danville, IL 61834
4. Nasco, 901 Janesville Avenue, Fort Atkinson, WI 53538
 - a. Electrical Wiring - 48 electrical wiring exercises showing a pictorial drawing and schematic of each.

5. Ohio Agricultural Education, Curriculum Materials Service, Room 254, 2120 Fyffe Road, Ohio State University, Columbus, OH 43210-1099
 - a. Demonstrations and Related Information for Teaching Electricity and Wiring - 15 demonstrations covering how circuits function, grounding and polarizing circuits, voltage loss and three wire service.
 - b. Electricity and Electrical Wiring - 4 manuals covering electrical power; current anatomy; conductors, insulators and their use; and distribution of electricity on home and farm.
 - c. Home Electrical Repair - cover common electrical maintenance and repair problems.
 - d. Wiring Simplified - 35th Edition - 1986 - Practical handbook outlining techniques, materials and devices to be used in various types of electrical installations.
6. Zaber, Paul and Gordon Rockmaker, Basic Electricity: A Text-lab Manual McGraw-Hill, P.O. Box 401, Highstown, NJ 08520 1989

MEDIA:

1. Bergwall Productions, P.O. Box 238, Garden City, NY 11530-0238
 - a. Basic AC Electricity - 12 filmstrips with 12 cassettes and study guides covers: alternating current - what it is and where it is used; voltage and power, magnetism and electromagnetism; inductors and inductive reactance; transformers; capacitors; capacitors and capacitive reactance; capacitors in series and parallel.
 - b. Basic DC Electricity - 7 filmstrips with 7 cassettes and study guides covers: electron theory; circuits, symbols and diagrams, meter reading and Ohm's law; series circuits; parallel circuits; complex circuits; resistors and rheostats.
 - c. Basic Electricity and Electronics: Alternating Current - for Apple Computer, covers: introduction to alternating current, current, voltage and power; magnetism and electromagnetism, inductors and inductive reactance; transformers; capacitors and capacitive reactance; inductors and capacitors in alternating current circuits.
 - d. Basic Electricity and Electronics: Alternating Current - 10 filmstrips with cassettes, covers: alternating current: what it is and where it is used; voltage and power; oscilloscopes: how to use them, measuring voltage and frequency, using lissasour patterns; magnetism and electromagnetism, inductors and inductive reactance; transformers; capacitors and capacitive reactance; inductors and capacitors in alternating current circuits.

- e. Basic Electricity: Direct Current - 4 VHS Cassettes with study guide, covers: electron flow; symbols, diagrams and circuits, ammeters and voltmeters, Ohm's law in action.
 - f. Basic Electricity & Electronics: Direct Current - for Apple Computer, or 6VHS Cassettes and study, covers: electron theory; circuits, symbols and diagrams, meter reading and Ohm's law, series circuits; parallel circuits, resistors and complex circuits.
2. CACareer Aids, 20147 Nordhoff Street, Chatsworth, CA 91311
- a. Basic Electronics - for Apple or IBM computers, covers: dc circuits; semi-conductors; ac circuits; basic electronics
 - b. Electric Circuits - for Apple computer, covers: structure of simple circuits, complex circuits with insulators and conductors.
 - c. Electricity - for Apple computer, covers: many topics dealing with electricity and circuitry, sources of electricity, magnetism, charges, circuits, current and more.
 - d. Electricity and Electronics Review - for Apple or IBM computers, covers: electric motor review; electric principles and related review; Ohm's law, series and parallel circuits.
 - e. Introduction to Alternating Current - for Apple computer, covers: where ac current is used; how ac current is measured; nature of alternating current; measuring ac frequency; summary.
3. Hobar Publications, Inc., 1234 Tiller Lane, St. Paul, MN 55112
- a. Basic Electrical Projects - 60 minutes video, covers: ABC's of electricity, replacing fixture, extending a circuit, code requirements and safety information.
 - b. Basic Electronics and Related Reviews - for Apple, IBM, TRS, MAC computers, covers: 350 multiple questions on electrical terms, components and circuits for study and testing.
 - c. Electrical Principles and Wiring Review - for Apple, IBM, TRS, MAC computers, covers: approximately 400 questions in 5 files on basic electricity, grounding, transmission, measuring and practical wiring practices.
 - d. Electrical Safety in the Home - 59 frame filmstrip or video tape.
 - e. Electrical Wiring - AAVIM - 3rd Edition, 320 slides, 10 cassette tapes, script, manual, teacher guide and student workbook, covers: reading and interpreting wire plans, connecting circuits, installing and connecting receptacles and switches, installing service equipment.

- f. Electrical Wiring - for Apple computer, covers: 180 questions from Electrical Wiring.
 - g. Electrical Wiring - 4 units of filmstrips and cassettes, covers: electrical connections; wiring materials I and II; electrical circuit installation.
 - h. Electrical Work - VHS video format - 32 minutes, covers: running new wire in open stud walls, wiring receptacles, switches and lights, new outlets in existing circuits, safety codes, tools and materials.
 - i. Wiring a Switch and Lamp - 60 slides, script and 18 minute cassette, covers: complete step by step procedure for wiring a single pole switch loop.
 - j. Wiring 3-way and 4-way Switches - 65 slides, script and 20 minute cassette tape, covers: step by step procedure of wiring a 3- and 4-way switch loop.
4. Interstate Printers and Publishers, P.O. Box 50, Danville, IL 61834-0050
- a. Electrical Identification Kit - 158 pictures of components found in an electric shop and laboratory
5. Ohio Agricultural Education, Curriculum Materials and Service, Room 254, 2120 Fyffe Road, Ohio State University, Columbus, OH 43210-1099
- a. Electrical Principles and Wiring Review - for Apple and IBM computers, covers: 400 review questions covering basic electricity, grounding, transmission, measuring and wiring practices.
 - b. Electrical Wiring-Residential-Utility Buildings-Service Area - AAVIM - 1987, 320 slides, 10 cassette tapes, manual, teacher guide, student workbook and script, covers: step by step procedure for reading and interpreting wire plans, installing wiring, connecting circuits, grounding electrical circuits and systems, installing and connecting receptacles, estimating use costs, installing switches, installing service entrance equipment and wiring, installing conduit, agricultural applications.
 - c. Understanding Electricity and Electrical Terms - AAVIM - 1986, 80 slides keyed with student manual
6. Vocational Agricultural Service, College of Agriculture, University of Illinois, 1401 South Maryland Drive, Urbana, IL 61801
- a. Identification of Electrical Wiring Terms - 66 frame filmstrip
 - b. Wiring Exercises - 48 wiring exercises.

INDIVIDUAL TEACHER UNIT REVIEW

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1. Student Activities --

2. Teacher Activities --

3. Evaluation Methods -

B. ADDITIONAL AND UPDATED REFERENCES:

1. Media -

2. Bibliography --

C. ADDITIONAL AND UPDATED RESOURCES INCLUDING ADDRESSES AND PHONE NUMBERS:

1. Resources

Address

Phone

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Plumbing

LENGTH: One - three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 9 or 10

OBJECTIVES: The students will be able to:

1. Cut, thread and fit galvanized pipe.
2. Cut and sweat copper tubing and fittings.
3. Flare copper tubing.
4. Cut and join plastic pipe.
5. Make simple plumbing repairs.
6. Identify common plumbing fittings.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Plant Maintenance Mechanics	357:1(a-h), 358:2(n, aa, bb, cc), 358:3(a-e, f)
Production Agriculture Mechanics	288:1(a), 288:2(a, b, d, f, g, h, i,) 288:3(a), 289:3(b-f), 290:9(a, b, c, d, f, h, i, j), 295:20(a-u), 296:22(a-j)

CONTENT:

I. Safety

- A. eye protection
- B. body protection, including hands and face

II. Pipe threading

- A. cut pipe to correct measurement
- B. ream pipe
- C. thread pipe

III. Plastic pipe

- A. cut pipe to correct measurement
- B. prepare pipe
- C. connect using proper material

IV. Copper tubing

- A. cutting
- B. reaming
- C. soldering and flaring joints

TEACHER ACTIVITIES:

1. Hand out prepared directions for each exercise.
2. Demonstrate:
 - A. use of measuring tools
 - B. cutting pipe threads
 - C. reaming pipe
 - D. preparing plastic pipe
 - E. cutting copper tubing
 - F. cleaning copper tubing
 - G. sweating and flaring joints
3. Evaluate students' projects.
4. Observe and supervise student activities.

STUDENT ACTIVITIES:

1. Complete exercise assigned.
2. Follow all safety practices.
3. Maintain a notebook of notes and reference materials handed out.

EVALUATION

1. Score sheets for exercise.
2. Written quizzes and exams.
3. Evaluate notebook.
4. Follow-up evaluation of students' projects.

RESOURCES:

1. School supplied materials.
2. Work sheets.
3. Text books.

BIBLIOGRAPHY:

References:

3 M, Guide to Plumbing, McGraw Hill, 1980

T.J. Wakeman, Modern Agriculture Mechanics, Interstate Printers and Publishers, 1977

Phipps, Lloyd J., Farm Mechanics Text and Handbook, Interstate Printers and Publishers, Danville, IL

Ingeles, Jack. Ornamental Horticulture. Albany, New York: Delmar Publishing Co., 1985.

MEDIA:

Leichtung Workshops, 4944 Comemrce Parkway, Cleveland, OH 44128

- a. "Common Home Repairs"
- b. "Plumbing"

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AGRICULTURAL MECHANICS CURRICULUM

UNIT: Power Tools

LENGTH: One - two weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 9 or 10

OBJECTIVES: The students will be able to:

1. Operate power tools safely.
2. Determine what tool to use.
3. Identify power tools and their parts.
4. Maintain power tool.
5. Use owner's manual.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanics	288:1(a, h,), 288:2(a, j), 289:4(b, c, i, m, n), 290:8(k)
Set-up Mechanic of Farms	
Industrial Equipment	301:8(a-m)
Tractor Mechanics Helper	305:12(a-q)

CONTENT:

- I. Introduction to power tools and their use related to agriculture and agribusiness
 - A. electrical safety
 - B. general safety practices (safety glasses, clothing)
 - C. purchasing/rental of power tools
 - D. costs in ownership
 - E. rechargeable tools/variable speed tools
- II. Types of Saws
 - A. table saw
 - B. portable circular saw
 - C. band saw
 - D. sabre saw
 - E. radial arm saw
- III. Blades
 - A. selection
 - B. types

IV. Drills

- A. drill press
- B. portable hand drills
- C. drill bit selection

V. Grinders

- A. portable disk grinders
- B. pedestal grinders
- C. belt grinders
- D. abrasive selection

VI. Sanders

- A. belt sander
- B. disk sander
- C. finish sander
- D. Air sander

VII. Other power tools

- A. router
- B. jointer
- C. Lathe (wood) (metal)
- D. planer-surfacer

VIII. Air tools

- A. chisel
- B. impact wrench
- c. nailer/stapler

TEACHER ACTIVITIES:

1. Demonstrate the safe use of all power tools that are being used in vo-ag classes.
2. Discuss the importance of using the proper size electrical cords.
3. Complete work sheets and safety exam on power tool.
4. Use operator's manual and identify the various parts of the power tool.
5. Develop a notebook of all class handouts and catalogs.

STUDENT ACTIVITIES:

1. Develop a list of power tools that are likely to be used in a shop.
2. Operate power tools safely.
3. Complete work sheet and safety exam on each power tool.
4. Use operator's manual and identify the various parts of the power tool.
5. Develop a notebook of all class handouts and catalogs.

EVALUATION:

1. Worksheets and safety exams.
2. Notebooks and catalogs.
3. Evaluate student performance and participation.

RESOURCES:

1. Vo-Ag power tools.
2. Supply catalogs.
3. Local tool supplier and lumber yard tool center.
4. Student's own tools.

BIBLIOGRAPHY:

References:

Power tool Safety and Operation, Hobar Publication, 1305 Miller Lane, St. Paul, MN 55112.

Shop Safety Skills, AAVIM, Athens, GA.

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- | 1. Resources | Address | Phone |
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D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

- 1.
- 2.
- 3.

AGRICULTURAL MECHANICS CURRICULUM

- UNIT: Shop Safety, Math, Painting and Glazing
- LENGTH: Three weeks. Select areas of content by student needs and time available.
- WHEN TAUGHT: Grade 9 or 10
- OBJECTIVES: The students will be able to:
1. State safety measures in agricultural mechanics.
 2. Read and compute mathematical problems as related to agricultural mechanics.
 3. State the importance of using good paint, stain and wood preservatives.
 4. Prepare a surface for paints, stains, preservatives.
 5. Mix and apply paint, stain and preservatives.
 6. Clean and store painting equipment.
 7. Measure and cut glass.
 8. Prepare a sash for fitting and fastening the glass.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanics	288:1(a-k), 288:2(a, b, c, f), 288:3(a), 289:3(a-f), 289:4(a-n), 289:5(a-i), 296:24(a-d)
Tractor Mechanics Helper	305:12(a-q)
Set-up Mechanic	301:8(a-m)
Farm equipment Salesman	320:3(a), 320:5(a-e), 320:6(a-c)
Small Engine Mechanic	312:13(a), 313:13(b-e)
Farm Tractor & Equipment Operation	314:1(a-d), 315(e-k)
Partsman in Farm Machinery Dealership	306:1(a, b, c, i, o), 307:1(p, t, z, aa), 308:5(a-g)

CONTENT:

- I. Shop safety
 - A. shop dress
 - B. shop behavior
 - C. color dynamics coding
 - D. proper fire fighting procedure and equipment
 - E. safe handling of all shop materials

- F. safe lifting procedures
- G. preventing falls
- H. carbon monoxide and fumes (ventilation)
- I. electricity and lightning
- J. compressed air safety
- K. general first aid shop procedure
- L. hand tool safety
- M. power tool safety
- N. OSHA
- O. MSDA forms

II. Mathematical computations

- A. applying dimensions to drawing
- B. figuring bills of materials
- C. computing board feet
- D. reading rulers, squares, levels and gauges
- E. metric conversions
- F. determining ratios
- G. determining areas, volume, capacity and weight

III. Painting, staining and preservatives

- A. importance of painting, staining, preservatives
- B. paint failures, causes and prevention
- C. kinds of paints and stains
- D. ingredients
- E. selecting materials
- F. estimating amount of paint/stain to use
- G. preparing surfaces
- H. masking
- I. mixing
- J. thinning
- K. applying (brush/roller/spray)
- L. cleaning and storing paint/equipment
- M. disposal of paints/stains
- N. finishing and refinishing

IV. Glazing

- A. safe handling of glass and glazing materials
- B. importance of glazing
- C. use of plexiglass
- D. types of glass
 - a. safety
 - b. wire reinforced
 - c. energy efficient
- E. glazing compounds and safe disposal of
- F. measuring glass
- G. preparing a sash and fitting windows
- H. storage of glass

TEACHER ACTIVITIES:

1. Demonstrating proper safety skills in shop environment.
2. Use of visuals to show safe and unsafe shop skills.
3. Acquaint students with appropriate safety measures involved with glazing and paints, stains, preservatives.
4. Review mathematical calculations appropriate to mechanics.
5. Provide lab sheets, materials, equipment, references.
6. Quizzes, examinations, projects.

STUDENT ACTIVITIES:

1. Maintain notebook.
2. Complete laboratory sheets.
3. Participate in class.
4. Perform practical math activities.
5. Prepare surfaces of wood and metal and apply paint/stain/preservatives.
6. Cut glass and apply to sash.
7. Quizzes and examinations.
8. Identification of kinds of glass/plexiglass.

EVALUATION:

1. Projects will be evaluated.
2. Quizzes and examinations.
3. Laboratory sheets.

RESOURCES:

1. Suitable working environment.
2. Selection of paints, stains, preservatives.
3. Selection of applying equipment.
4. Selection of glass, plexiglass, glazing compounds.
5. Rulers, squares and other mathematical aids.
6. Resource people from business/industry to demonstrate shop safety skills.

BIBLIOGRAPHY:

References:

Safe Practices Series, 1986, leaders manual, E.I. dePont de Nemours & Co., Inc. Wilmington, DE 19898

MEDIA:

Building Trades Math, (filmstrip), SATCO, 924 19th Avenue, Minneapolis, MN 55404

Developing Shop Safety Skills, (slides), AAVIM, 120 Driftmier Engineering Center, Athens, GA 30602

Hand Tool Basics, (video), Creative Educational Video, 5147-A 69th Street, Lubbock, TX 79424

Home and Farmstead Safety, (disk), ACCESS, National FFA Center, P.O. Box 15160, Alexandria, VA 22309

Interior Paint and Wallpaper, (video), AAVIM, 120 Driftmier Engineering Center, Athens, GA 30602

Safety, (filmstrip), AAVIM, 120 Driftmier Engineering Center, Athens, GA 30602

Safety Color Coding for the Shop, (filmstrip), AAVIM, 120 Driftmier Engineering Center, Athens, GA 30602

Tools for Measuring Wood, (video), Creative Educational Video, 5147-A 69th Street, Lubbock, TX 79424

Tool Safety: Shop Laboratory, (disk), ACCESS, National FFA Center, P.O. Box 15160, Alexandria, VA 22309

Types and Cost Calculations of Wood Buildings, (disk) ACCESS, National FFA Center, P.O. Box 15160, Alexandria, VA 22309

SI: Length and Area, (detailed overview of metrics), Meridian Education Corp., 205 E. Locust Street, Bloomington, IL 61701

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AGRICULTURAL MECHANICS CURRICULUM

UNIT: Small Engines, Basic Care and Operation

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 9 or 10

OBJECTIVES: The students will be able to:

1. Demonstrate safety procedures when working on small gas engines.
2. Demonstrate proper tool usage.
3. Identify parts of engine.
4. Identify parts of carburetor.
5. Define the principles of operation (compression, carburetion, ignition) of small gasoline and diesel engines.
6. Select proper repair parts needed to tune up the engines using service manuals, microfilm, and owner's manual.
7. Clean, regap or replace a spark plug.
8. Replace and adjust ignition points using proper tools.
9. Test, replace or adjust ignition components using proper tools.
10. Adjust carburetor for efficient performance.
11. Explain principles of carburetor operation.
12. Identify types of air cleaners.
13. Service air cleaners.
14. Demonstrate procedures for storage.
15. Select the proper lubrication for 2 cycle and 4 cycle stroke engines.
16. Define the importance of keeping engines clean.
17. Mix 2-cycle oil properly.
18. Maintain proper crankcase oil levels.
19. Troubleshoot minor mechanical defects.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Small Engine Mechanic

310-313

CONTENT:

I. Safety

- A. proper use of safety glasses
- B. safe use of cleaning solvents
- C. safe handling of flammable materials
- D. disconnect the spark plug wires
- E. disengage clutch
- F. clamping engine to bench or use of engine stand
- G. proper use of tools, testing equipment

II. Principles of operation

- A. types of engines (2-cycle, 4-cycle, diesel)
- B. operation of gasoline engines
- C. operation of diesel engines

III. Use of reference information

- A. read and use parts manual
- B. operate microfilm reader
- C. use operator's manual
- D. use of service manual

IV. Ignition systems

- A. replace spark plug
- B. clean spark plug
- C. gap and regap spark plug
- D. replace breaker points
- E. gap or regap breaker points
- F. test condenser
- G. replace condenser
- H. test coil
- I. replace coil (if necessary)
- J. adjust air gap
- K. inspect key way and key for wear
- L. electronic ignition
- M. ignition of diesel systems

V. Compression

- A. check for reason of low compression
- B. clean head
- C. torque head bolts
- D. replace gasket (head)
- E. inspect valves for opening and closing

VI. Carburetion

- A. principles of operation
- B. type of carburetors
- C. clean carburetor
- D. check choke
- E. make adjustments
- F. check for air leaks
- G. function of air cleaner
- H. clean air cleaner
- I. check linkages
- J. injectors

VII. Lubrication and fuel

- A. fuel types and recommendations
- B. oil types
- C. maintenance of oil levels
- D. grease
- E. avoiding fire hazards
- F. removing water from diesel fuel systems

VIII. Storage of engine

- A. fuel recommendations
- B. fuel preservatives
- C. change oil
- D. clean air cleaner
- E. lubricate cylinder

TEACHER ACTIVITIES:

1. Present safety rules and procedures.
2. Observe and supervise student activities to insure proper skill development.
3. Indicate examples of improper engine maintenance.
4. Demonstrate proper procedure for servicing and maintaining small gasoline engines.
5. Guide students in using references.
6. Create a checklist to keep track of student skills successfully completed.
7. Use cut-away engine to explain engine parts and operation.
8. Demonstrate mixing of 2-cycle oil and gasoline.
9. Demonstrate use of torque wrench.

STUDENT ACTIVITIES:

1. Keep a notebook of handout materials and class notes.
2. Prepare a checklist of safety procedures to follow before, during and after starting a small engine.
3. Complete class handouts.
4. Students will be given defective parts and should use references to order replacements.
5. Service the ignition system, carburetor, air cleaner and recoil.
6. Inspect and clean engines that are available to the student.
7. Prepare an engine for storage.
8. Reset carburetor for maximum performance.
9. Complete a worksheet on an engine which asks for specific information.
10. Observe gasoline and diesel units to compare differences in methods of supplying fuel to the cylinders and ignition systems.
11. Identify from a description of engine whether it is a gasoline or diesel power unit.
12. Participate in classroom and laboratory activities.

EVALUATION:

1. Fill out checklist of students progress in accomplishing unit objectives.
2. Classroom test and quizzes.
3. Monitor students skill development.
4. Practical test on shop skills.

RESOURCES:

1. Small gasoline engines.
2. Parts for appropriate engines.
3. Lubricants.
4. Cleaning solvents.
5. Testing equipment.
6. Small engine hand tools.

7. Special tools.
8. Engine stands.
9. Microfilm reader and microfilm.
10. W.J. Connell Co., 65 Green Street, P.O. Box 192, Foxboro, MA 02035 - this company offers a program of specialized Tecumseh training kits. The kit can be either leased or sold to the schools. Each kit will have the necessary teaching aids, including engines, transmissions, and transaxles. All audio visual aids, books, and charts will be included.

Four basic kits are made to instruct in the following categories:

1. two cycle engine overhaul (tvs 840)
 2. four cycle engine overhaul (tvs 90)
 3. four cycle overhead valve engine overhaul (ovm 120)
 4. transmissions and transaxle service (700 & 900 series)
11. Operator manuals
 12. Cut-away models of 2 cycle and 4 cycle engines.

BIBLIOGRAPHY:

References:

Briggs and Stratton Corp., Milwaukee, Wisconsin, Briggs and Stratton Parts Manual.

Crouse, William and Donald Anglin. Small Engine Mechanics, 1986 McGraw Hill Publishing Co., P.O. Box 401, Highstown, NJ 08250, A text, workbook and instructors planning guide.

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112.

- a. Small Gasoline Engines - 1984, student manual covering CDI solid state ignition, automatic chokes, no choke carburetors and fuel pump systems.
- b. Service & Repair Instructions - (Briggs & Stratton) 1984, 80 pages of classroom and laboratory exercises plus general theories of operation.
- c. Small Gasoline Engines - Student Job Sheet, instructional packet includes 23 jobs sheets on small engines beginning with identification and specifications, disassembly and reassembly specifications.
- d. Small Engine Repair Series - series of 10 manuals with emphasis on repair and maintenance. Covers pints and condenser, electronic ignition, starter, carburetors, valves, governors, lubrication, storage, blades and troubleshooting.

- e. Air Cooled Engine Mechanics Training Manual - put together from Engine Service Association and leading manufacturers - principles of operation, service, maintenance of air cooled engines.
- f. Care and Operation of Small Gasoline Engines - 4th Edition comes with a computer software program that is designed to bring students to an entry level of competency for servicing and operating small gasoline engines.
- g. Diesel Fuel System-Principles, Maintenance and Servicing - 80 page teachers manual and student manual of diesel subject matter, teaching suggestions and 8 exercises.
- h. Maintaining Small Engines - 16 units on small engine maintenance to provide minimum skills for disadvantaged and handicapped students.
- i. Small Diesel Engines Service Manual (Intertec) - covers 80 models of diesel engines up to 160 cubic inch displacement; covers air-cooled and liquid cooled engines.

Instructional Materials Service, 24 Roberts Hall - Cornell University, Ithaca, New York 14853-5901

- M101 Kohler - Single Cylinder Engine Service Manual (78 pages)
- M102 The Ignition System - Testing and Analyzing (28 pages)
- M103 Engine Compression and Cylinder Leakage (16 pages)
- M109 Small Engines-Repair and Overhaul 4-Cycle Engines (20 pages)
- M110 The Two Cycle Engines (20 pages)
- M112 Repair Instructions for Briggs and Stratton Engine IV (156 pages)
- M118 Briggs & Stratton Engine Specifications (chart)
- M119 4-Stroke Cycle Tecumseh Engine Specifications (chart)
- M120 Small Tractor Service Manual - Volume I (272 pages) (covers Briggs & Stratton, Kohler, Tecumseh, Wisconsin)
- M121 Small Tractor Service Manual - Volume II (272 pages) (brands not covered in first volume)
- M130 Maintaining Small Engines (300 pages)
- M136 Comprehensive Small Engine Repair (900) pages

Step By Step Small Engines Repair - a series of ten well illustrated and easy-to-read materials showing basic step-by-step repair procedures for Briggs & Stratton Engines.

- M150 Installing Breaker Points and Condenser
- M151 Magnetron Ignition
- M152 Carburetors: Service and Repair
- M153 Starter: Service and Repair
- M154 Valves: Service and Repair
- M155 Governors: Repair and Adjustment
- M156 Lubricating Small Engines
- M157 Operating and Storing Small Engines
- M158 Troubleshooting Small Engines
- M159 Maintenance Procedures: Height Adjustment, Blade Balancing and Sharpening, and Mufflers

Nasco, 901 Janesville Avenue, Fort Atkinson, WI 53538

- a. Small Gas Engines, Alfred C. Roth - basic information on small engine construction, how systems operate, lubrication requirements, preventative maintenance practices, servicing techniques and rebuilding procedures. Covers one- and two-cylinder, two- and four-cycle gasoline engines plus rotary engines, diesel and LP gas engines.
- b. Diesel-Fundamentals Service, Repair, Bill Toboldt - basic fundamentals of diesel operation, design, classification and construction. Extensive information on various systems which provide lubrication, exhaust, filtering, starting, cooling and governing with special emphasis on fuel injectors and ignition systems.

Ohio Agricultural Education, Curriculum Materials Service, Room 254, 2120 Fyffe Road, Ohio State University, Columbus, Ohio 43210-1099

- a. Diesel Mechanics: Fundamentals 1982 - 29 units of instruction plus 185 transparency masters
- b. Diesel Mechanics: Fuel Systems 1982 - 8 units of instruction plus 43 transparency masters
- c. Small Engine Repair: Two-Stroke and Four-Stroke Cycle - 21 units of instruction plus 131 transparency masters

Tecumseh Products Company, 900 North Street, Grafton, Wisconsin 53024

- a. Tecumseh Mechanics Manual - Partno 691630
- b. 2 Cycle Engine Manual - Partno 692508
- c. TC-200 2 Cycle Engine Manual - Partno 694782
- d. 4 Cycle Engine Manual, 3 to 10 HP and OVM120 - Partno 692509
- e. 4 Cycle Engine Manual, 8 to 10 HP (cast iron) - Partno 691462A
- f. Tecumseh Specialty Tools - Partno 694862

MEDIA:

Bergwall Productions, Inc., P.O. Box 238, Garden City, NY 11530-0238

- a. Small Engines Explained - 9 filmstrips with cassettes and study guide or video transfer program which includes 9 VHS cassetts with study guide. Covers: basic parts and operations: four-stroke cycle engine; engine disassembly; inspection and valve reconditioning; cylinder reconditioning; engine assembly; ignition system; fuel system; carburetor service; and routine care and maintenance.

CACareer Aids, 20417 Nordhoff Street, Department B4, Chatsworth, CA 91311

- a. Care and Operation of Small Gas Engines - for Apple computer. Covers: the basic operating principles of 2-cycle and 4-cycle engines. Step-by-step procedure for routine service jobs such as cleaning, lubricating and refueling.
- b. Small Gas Engine Parts Identification - for Apple computer. Covers: teach students to identify small engine parts. As student takes test grades are automatically recorded.

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112

- a. Spark Plug Service and Maintenance - 57 slides and 1 cassette. Covers: principles of spark plugs, selection, visual inspection for malfunction and complete procedures for testing and servicing plugs.
- b. Small Gas Engine Review - for IMB, Apple, TRS and MAC computers. Covers: 400 multiple choice questions for review and study. Tests can be produced from these questions.

Photocom, P.O. Box 3135, Pismo Beach, CA 93449

- a. Inside the Small Engine, Series I - 6 filmstrips, 6 cassettes. Covers: small engine service; small engine tune-up; two-stroke engine theory; ignition system theory and maintenance; fuel systems.
- b. Inside the Small Engine, Series II - 6 filmstrips, 6 cassettes. Covers: diesel engine theory and parts; electrical and starting systems; rotary theory, energy, work and power; lubrication, cooling and exhaust systems.
- c. Four-cycle Engine - for Apple computer. Covers: basic function of 4-cycle engine - follows all functions in the normal sequence of intake, compression stroke, ignition, and exhaust.
- d. Two-cycle Engine - for Apple computer. Covers: basic function of 2-cycle engine - demonstrates the operating sequence of the 2-cycle engine. Engine speed and stroke are always labeled.
- e. Firing Order (4-cycle Engine) - for Apple computer. Covers: firing order, valve sequence and repair - operating sequence showing staggering of pistons during operation.
- f. 2-Cycle Diesel Engine - for Apple computer. Covers: demonstrate operating principles of 2-cycle diesel engine.

NASCO, 901 Janesville Avenue, Fort Atkinson, WI 53538

- a. Small Engine Parts & Function - Compression - 80 frame filmstrip, cassette and study guide. Covers: parts of the small engine associated with compression are pictured and their function in the process explained.
- b. Small Engine Parts & Function - Fuel Air Induction - 80 frame filmstrip, cassette and study guide. Covers: parts of the small engine associated with fuel-air induction and their function in the process explained.
- c. Small Gasoline Engines - Revised Edition - set of 32 transparencies. Covers: cooling, lubrication, carburetion and ignition

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C. ADDITIONAL AND UPDATED RESOURCES INCLUDING ADDRESSES AND PHONE NUMBERS:

- | 1. Resources | Address | Phone |
|--------------|---------|-------|
|--------------|---------|-------|

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

- 1.
- 2.
- 3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Tool Sharpening and Fitting

LENGTH: One - three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 9 or 10

OBJECTIVES: The students will be able to:

1. Safely operate the power grinder, and appropriate hand tools.
2. Be aware of the danger involved in using dull, mushroomed or insecurely handled tools.
3. Identify basic metal working tools.
4. Identify common metals.
5. Sharpen a twist, drill, plane blade or wood chisel, cold chisel and screw driver.
6. Demonstrate use of calipers, micrometers, and rulers.
7. Properly rehandle tool.
8. Reshape and sharpen cutting tool.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic 288:1 (a-k), 290:8 (a-n)

CONTENT:

I. Safety in tool sharpening and fitting

- A. eye protection and proper dress
- B. safe grinder use
- C. grinder care - dress and truing wheels, adjusting tool rest
- D. tools - mushroomed heads, loose handles, dull tools, injuries during sharpening
- E. guards and tool rest

II. Metal identification

- A. low carbon steel
- B. medium carbon steel
- C. high carbon steel
- D. cast iron
- E. non-ferrous
- F. tempered steel

III. Tool identification

IV. Sharpening tools

- A. use a template
- B. check for sharpness

V. Reshaping and sharpening tools

- A. laying out curve
- B. grinding out nicks
- C. using gauge to grind blade to proper taper
- D. using files and stones to sharpen blade

VI. Sharpening other tools

- A. use of calipers, micrometers, and rulers
- B. reshaping
- C. honing
- D. testing for sharpness

TEACHER ACTIVITIES:

1. Review safety.
 - a. eye protection and proper dress
 - b. safe grinder use
 - c. grinder care - dressing and truing wheels, adjusting tool rest
 - d. tools - mushroomed heads, loose handles, dull tools, injuries during sharpening
 - e. guards and tool rest
2. Introduction: show examples of dull, mushroomed, and poorly handled tools. Emphasize cost, inconvenience, and safety factors.
3. Demonstrate:
 - a. use of a template, calipers, micrometers and rulers
 - b. sharpening a twist drill, cold chisel and plane blade
4. Demonstrate proper method of sharpening and refitting tools.
5. Hand out prepared directions for each exercise.
6. Observe and supervise student activities.
7. Evaluate students' projects.

STUDENT ACTIVITIES:

1. Follow all safety practices.
2. Bring in tools to be sharpened and fitted.

3. Complete exercise assigned.
4. Maintain a notebook of notes and reference materials handed out.
5. Fit one handle for teacher evaluation.
6. Sharpen one or more tools for evaluation.
7. Make some type of simple guard for cutting tool.
8. Make a handle holder to protect handles from vise jaws.

EVALUATION:

1. Score sheets for each exercise.
2. Written quizzes and exams.
3. Evaluate notebook.
4. Follow-up evaluation of student's projects.

RESOURCES:

1. Students' and parents' tools.
2. School supplied materials.
3. Work sheets.
4. Text books.
5. Examples of mushroomed heads, loose and broken handles.
6. Gauges and vise handle holder.

BIBLIOGRAPHY:

Reference:

1. Phipps, Lloyd J, Farm Mechanics Text and Handbook, The Interstate Publishing Co., Danville, Illinois.
2. Sharpening Hand Tools, Vocational Agriculture Service, College of Agriculture, Urbana, IL.
3. Sharpening a Plane Iron, Department of Agricultural Education, Pennsylvania State University.
4. Sharpening a Twist Drill Bit, Department of Agricultural Education, Pennsylvania State University.

5. Sharpening a Wood Chisel, Department of Agricultural Education, Pennsylvania State University.
6. Shinn, Weston, Working in Agricultural Mechanics, Gregg/McGraw Hill, 1978.
7. Simmons, Fred C., The Northeastern Loggers Handbook, USDA Handbook #6, U.S. Government Printing Service, 1951.
8. Elmer L. Cooper, Agriculture Mechanics: Fundamentals and Applications, Delmar Publishers, Marketing Services, 2 Computer Drive, West, Box 15015, Albany, New York (instructors guide)

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AGRICULTURAL MECHANICS CURRICULUM

UNIT: Tractor Operation

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 9 and 10

OBJECTIVES: The students will be able to:

1. Explain safety procedures to follow when operating a tractor, implements, and attachments.
2. Identify service jobs required to maintain the tractor.
3. Maintain proper ownership and maintenance records.
4. Pre-operational safety check.
5. Demonstrate safe starting, maneuvering, and stopping of the tractor.
6. Demonstrate hand signals related to safe tractor operation.
7. Demonstrate proper tractor operation.
 - a. 2-wheel drive
 - b. 4-wheel drive
 - c. with implements
8. Safely hitch and unhitch.
9. Safely attach and detach PTO shaft.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Lift Truck Operator
Farm Tractor and Equipment
Operator

351-352

314:1(a-d), 315:1(e-k), 315:2(a-b),
315:3, 316:3(a), 316:4(a), 316:5(a),
317:5(b-d), 318:6(a), 318:7(a),
318:8(a)

CONTENT:

I. Tractors

- A. History
- B. 2 wheel-drive tractors
- C. 4 wheel-drive tractors

II. Safety

A. plan ahead to avoid accidents

1. don't be in a hurry
2. reaction time awareness
3. start with safe equipment

B. tractor accidents are the most common farm accident - therefore use every precaution...

1. no extra riders
2. leave shields in proper position
3. use roll-over protection and fasten seat belts
4. drive at safe speeds
5. use proper hitch areas
6. use "slow moving vehicle" emblems
7. operate tractor in a non-hazardous area
8. operate the tractor safely in all driving situations
9. shut down tractor before refueling
10. use and store fuel safely.
11. use fire extinguisher safety
12. use radiator safety
13. consider exhaust gas safety
14. consider personal safety.

III. preliminary starting procedures

A. proper ventilation

B. clear obstacles out of the way

C. check the following:

1. tires
2. radiator coolant
3. air-cleaner assembly
4. electrolyte in battery
5. fuel
6. crankcase

D. check seat adjustment and seat belts

E. check brakes (remember on road/off road positions)

IV. Controlling tractor movement

A. start tractor following owner's manual recommendations

1. starting gasoline engines
2. starting diesel engines
3. starting LPG tractors

B. check instrument panel

1. oil pressure indicator
2. charge indicator
3. cooling system gauge
4. engine speed indicator
5. fuel gauge

C. operating a tractor

1. safe day time driving
2. safe night time driving
3. on road driving
4. off road driving
5. negotiation of...
 - a. speed
 - b. corners
 - c. turns
 - d. power steering vs. manual steering
 - e. braking
 - f. shifting
 - g. clutching
 - h. incline
 - i. decline

D. stop tractor and shut down all accessories and implements

V. Special conditions

- A. seasonal
- B. starting procedures for different tractor types
- C. fuel additives

VI. Hitching to tractor-operated equipment

- A. attaching equipment to the drawbar
- B. hitching rear-mounted equipment
- C. PTO speeds, connections and safety
- D. hydraulic cylinder connections, pressures and safety
- E. safety shields in place
- F. hitching to belt-driven equipment
- G. unhitching equipment

VII. Practice driving - implements/attachments

A. safe use of common implements or attachments

1. mower decks
2. garden carts
3. tillage equipment
4. field equipment
5. loader
6. backhoe
7. other

B. safe operation

VIII. Fueling tractors

- A. fueling safety
- B. fueling with LP-Gas
- C. fueling with liquid fuels

IX. Tractor records and ownership

- A. records of maintenance
- B. registration

TEACHER ACTIVITIES:

1. Use lecture and discussion periods to...
 - a. make students aware of the importance of everyone learning tractor conduct and safety
 - b. acquaint students with tractor safety
 - c. show films, videos, filmstrips, slides pertaining to the unit
 - d. acquaint students with proper driving techniques
2. Demonstrate inspection, starting, driving, stopping, refueling.
3. Observe and give feedback to student drivers.
4. Provide lab sheets, references, and evaluation material to accomplish objectives.
5. Make students aware of the FFA Safe Tractor Driving Contest.
6. Provide or make available places for fieldtrips in regards to safety, equipment and more.
7. Make available the State of Connecticut Tractor Driving Course for students to obtain their permits.
8. Panel discussion by equipment dealers, farmers, safety personnel, former students on the importance of safety.
9. Other

STUDENT ACTIVITIES:

1. Maintain a notebook on lectures and discussions.
2. Complete lab sheets.
3. Start, drive, stop, and hitch tractor.
4. Become more proficient in controlling tractor movement through supervised practice.
5. If so desired, become involved in the FFA Safe Tractor Driving Contest as a contestant or contest helper.

6. Complete the State Department Tractor Driving Course and get your license.
7. Other

EVALUATION:

1. Notebooks.
2. Quizzes and written test on all material.
3. Inspection and driving skill test.
4. Monitor students' skills development.

RESOURCES:

1. Tractor companies in your area - tractors and implements.
2. Connecticut Cooperative Extension Service.
3. Reference materials and service manuals from lawn and garden and farm equipment dealers.
4. Resource people in your area.
5. FFA Foundation - national tractor safety campaigns.
6. Overhead transparencies.
7. Access - National FFA Supply Center.

BIBLIOGRAPHY:

References:

AAVIM, 120 Driftmier Engineering Center, Athens, Georgia 30601:

"Communicating for Safe Tractor Operation" 1985. #103 C.S.
(Computer Software) \$40.00.

"Safe Tractor Operation & Daily Care" 1981. #103 (manual)
\$11.00.

4-H Tractor Care and Safety Program, U.S. Government Printing
Office, 1973.

Eastern States, FFA Tractor Contest Course Score Sheets.

Tractor Operation and Daily Care, AAVIM (American Association for
Vocational Instructional Materials), Engineering Center. Athens,
Georgia 30601.

"Safety Tips" - Agricultural and Lawn/Garden Dealerships.

Farm Tractor and Machinery Operation Program, Cooperative Extension Service, College of Agriculture and Natural Resources, The University of Connecticut, Storrs, Connecticut.

Fundamentals of Machine Operation - Tractors, John Deere Service Training Department F., John Deere Road, Moline, Illinois 61265.

Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407, Small Tractor Service Manual, (1-790-820H) Volume 1 \$12.95.

John Deere Training Center, John Deere Road, Moline, Illinois 61265, Tractors Second Edition 1981.

Order:	FMO - 10102B	Text
	FMO - 10202S	Slides
	FMO - 10502T	Tractor's Guide
	FMO - 10602W	Tractor's Workbook
	FMO - 10402DA	Apple computer Program for Disc and documentation \$49.85
	FA - 005DA	Apple computer Quizmaster Disc and documentation \$27.50

Interstate Printers and Publishers, Inc., P.O. Box 50, Danville, Illinois 61834-0050 - Brown, Allen D. and R. Mack Stickland, Tractor and Small Engine Maintenance 5th Edition.

Delmar Publishing, 2 Computer Drive, Box 15015, Albany, New York 12212-5015 - Stephenson, George E., Power Technology, 4th Edition.

Text: ISBN0-8273-2446-4
Student Manual: ISBN - 8273-2424-3

MEDIA:

Siegel and Associates. Tractor Safety Begins With You, Kubota Tractor Presentation. Siegel and Associates, 19725 Sherman Way, Conoga Park, CA 91306 (818) 709-6525 (Video).

Deere and Company. John Deere Safety Programs, Deere and Company, Moline, Illinois 61265. Order number DKVHU 87573EN.

Deer and Company. John Deere Day - 1988 Highlights. Order number 0039549-0010008.

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1. Resources

Address

Phone

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRIGULTURAL MECHANICS CURRICULUM

UNIT: Woodworking, Sketching and Drawing

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 9 or 10

OBJECTIVES: The students will be able to:

1. Use sketching and drawing instruments safely.
2. Demonstrate how to measure accurately.
3. Select and identify drawing equipment.
4. Make a drawing to scale.
5. Select kinds and grades of lumber.
6. Layout and construct a woodworking project.
7. Demonstate the safe use of woodworking tools.
8. Figure a bill of materials.
9. Figure board feet and estimated costs.
10. Identify the various types of fasteners and where to use them.
11. Operate computer to design a project.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288:1(a, b, c, f, g, j, k), 288:2(a-j), 288:3(a), 289:3(b-f), 289:4(a-n), 296:24(a-d), 297:24(e), 297:25(a-e)
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CONTENT:

- I. Care and use of drawing/sketching materials
 - A. drawing tools and equipment
 - B. computer aided drawing (CAD)
 - C. paper
 - D. symbols
 - E. margins
 - F. types of drawing sketches
 - G. lettering, spacing, neatness

II. Fasteners

A. nails

1. types
2. sizes
3. uses

B. Screws

1. types
2. sizes
3. uses

C. bolts

1. types
2. sizes
3. uses

D. hinges

1. types
2. sizes
3. uses

E. adhesives

1. glue
2. applications

III. Wood

A. Kinds and grades of lumber and its application

1. veneer
2. plywood
3. laminates
4. hardwood
5. softwood

B. unit of measurment

1. board foot
2. linear foot
3. square foot

C. estimating cost

IV. Projects examples

- A. tool box
- B. birdhouse
- C. saw horse
- D. planters, etc.

V. Preserving and protecting

- A. paint
- B. stain
- C. varnish

TEACHER ACTIVITIES:

1. Demonstrate proper sketching and drawing techniques.
2. Provide necessary tools and materials for drawing.
3. Provide a variety of fasteners for students.
4. Provide a variety of fasteners for students.
5. Demonstrate layout and construction of woodworking project.
6. Provide laboratory sheets, reference materials and evaluation sheets.
7. Demonstrate computer aided drawing.

STUDENT ACTIVITIES:

1. Using the correct drawing tools, sketch a project to be constructed.
2. Figure a bill of materials for the project.
3. Using all materials provided, safely construct a project.

EVALUATION:

1. Worksheets and reference materials.
2. Sketches, drawings, project.
3. Student participation.

RESOURCES:

1. Drawing equipment.
2. Computer.
3. Fasteners.
4. Lumber and other construction materials.
5. Vo-Ag shop and power tools.

BIBLIOGRAPHY:

References:

Power Tool Safety and Operation, Hobar Publications, 1305 Tiller Lane, St. Paul, MN 55112.

Mechanics in Agriculture, Interstate Publishers, Danville, Illinois.

Shop Safety Sills, AAVIM, Athens, GA.

Phipps, Cook etc., Farm Mechanics Text and Handbook, Interstate Printers and Publishers, Danville, Illinois.

Shin, Glen C. and Weston, Curtiss R., Working in Agricultural Mechanics, Gregg Division, McGraw-Hill Book Co.

Wakeman, McCoy, The Farm Shop, The McMillan Co.

MEDIA:

AAVIM Filmstrips

Stanley Tool Co, New Britain, Connecticut

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2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Advanced Agricultural Welding

LENGTH: Four to six weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 or 12

OBJECTIVES: The students will be able to:

1. Demonstrate safe welding practices.
2. Select recommended electrodes.
3. Identify metals.
4. Arc weld flat, horizontal, vertical and overhead.
5. Apply hard surfacing material, using the arc welder, and oxyacetylene torch.
6. Weld cast iron.
7. Cut with the arc welder and oxyacetylene torch.
8. Braze with the oxyacetylene torch.
9. Weld sheet metal (spot welder, MIG, TIG).
10. Weld aluminum (MIG, TIG, oxyacetylene torch).

RELATED JOB TITLES AND RELEVANT COMPEIENCIES:

Production Agriculture Mechanic 288:3(a), 289:3(b-f), 289:6(a-m),
290:6(n-y), 290:7(a-u)

Plant Maintenance Mechanic 357:1(a-h), 358:2(l, m, n, r, w),
358:3(a-e, h, i)

CONTENT:

I. Safety

- A. eye protection needed
- B. hands, face and body protection
- C. fire extinguishers and how to use them
- D. use of the fire blankets

- II. Selecting electrodes
 - A. identify metals
 - B. use electrode selection guide
- III. Evaluating welds
 - A. external visual inspection
 - B. break test
 - C. cause of faulty welds
- IV. Weld horizontal, vertical and overhead
 - A. Selection of electrodes
 - 1. kind of metal
 - 2. thickness of metal
 - 3. strength needed
 - B. use the recommended amperage
 - C. cleaning weld
 - D. evaluating weld
- V. Hardsurfacing
 - A. using the arc welder
 - 1. preheating
 - 2. amperage setting
 - 3. motion
 - 4. penetration
 - 5. cooling
 - 6. selecting electrode
- VI. Cutting
 - A. arc welder
 - 1. select electrode
 - 2. amperage setting
 - 3. motion
- VII. Brazing
 - A. metal preparation
 - B. heat source - arc and oxyacetylene torch
 - C. flux
 - D. rod selection

VIII. Spot welding

- A. metal preparation
- B. amperage
- C. evaluating

TEACHER ACTIVITIES:

1. Discuss types of welders and their safe operation.
2. Demonstrate all practices.
3. Secure materials needed for practice.
4. Evaluate.

STUDENT ACTIVITIES:

1. Demonstrate safe welding practices.
2. Identify metals.
3. Select electrodes.
4. Practice welding:
 - A. padding
 - B. horizontal, vertical and overhead
 - C. hardsurfacing
 - D. cast iron welding
 - E. cutting
 - F. brazing
 - G. spot welding
 - H. MIG and TIG

EVALUATION:

1. Rate final practice piece.
2. Test welds.

RESOURCES:

1. Shop equipment.
2. Scrap metal.
3. Examples of good welds.

BIBLIOGRAPHY:

References:

Arc Welding, The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio

Elmer L. Cooper, Agriculture Mechanics: Fundamentals and Applications, Delmar Publishers, Marketing Services, 2 Computer Drive, West, Box 15015, Albany, New York (instructors guide).

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Seeber, Glen & Allen, Ray, Oxyacetylene Welding, California State Polytechnical College.

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Larry Jeffus & Harold V. Johnson, Welding: Principles and Applications, 2nd Edition, 1988, Delmar Publishers, Marketing Services, 2 Computer Drive, West, Box 15015, Albany, New York (instructors guide)

I.H. Griffin, E.M. Roden & C.W. Briggs, Basic Oxyacetylene Welding, 4th Edition, Delmar Publishers, Marketing Services, 2 Computer Drive, West, Box 15015, Albany, New York (instructors guide)

Arc Welding Project, Vol. I. C. 1958 and Vol. II C. 1978, The James F. Lincoln Arc Welding Foundation.

I.H. Griffin, E.M. Roden & C.W. Briggs, Welding Processes, 3rd Edition, Delmar Publishers, Marketing Services, 2 Computer Drive, West, Box 15015, Albany, New York (instructors guide).

Oxyacetylene Handbook, Linde Aire Products.

Seeber, Glen & Allen, Ray, Oxyacetylene Welding, California State Polytechnical College.

Sosin, H.S., Arc Welding Instructions for Beginners, the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, 1964.

Welding, FOS, Deere & Company, Moline, IL, 1971

I.H. Griffin, E.M. Roden & C.W. Briggs, Basic Tig & Mig Welding, 3rd Edition, Delmar Publishers, Marketing Services, 2 Computer Drive, West, Box 15015, Albany, New York (instructors guide)

MEDIA:

Basic Arc Welding Safety (video), Vocational Education Productions,
California Polytechnic State University, San Luis Obispo, CA 93407

Welding Equipment Safety and Operations (computer: IBM, Apple,
TRS-80), Shopware Educational Systems, Department PW-2, Route 1,
Box 330-E, Aberdeen, WA 98520-9984

Arc & Oxyacetylene Welding (videos), Video Trend, P.O. Box 524, St.
George, UT 84770, (801) 673-1601

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AGRICULTURAL MECHANICS CURRICULUM

- UNIT: Agricultural Machinery Repair and Maintenance
- LENGTH: Six weeks. Select areas of content by student needs and time available.
- WHEN TAUGHT: Grade 11 or 12
- OBJECTIVES: The students will be able to:
1. Demonstrate safe procedures when maintaining, servicing and repairing agricultural machinery.
 2. Identify proper sequence for ordering and stocking agricultural parts.
 3. Determine cost effectiveness of preventive maintenance vs. breakdown and replacement.
 4. Maintain and service agricultural machinery.
 5. Repair agricultural machinery.
 6. Plan and perform storage procedures for agricultural machinery.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Small Engine Mechanic	310-313
Plant Maintenance Mechanic	357-358
Production Agriculture Mechanic	288:3, 288:6, 290:6, 290:7, 291:8-11, 292:11-13, 293:13-16, 294:16
Partsman in Farm Machinery Dealership	306-309
Tractor Mechanics Helper	302

CONTENT:

- I. Safety
 - A. proper use of personal safety items
 - B. safe use of cleaning solvents and equipment
 - C. safe handling of flammable materials
 - D. safe use of jacks, jack stands, and lifts
 - E. proper use of tools and equipment
- II. Establish need for machinery maintenance and repair
 - A. review essentials of scheduling service
 - B. review essentials of ordering and stocking of parts
 - C. review cost effectiveness of preventive maintenance vs. breakdown and replacement

III. Maintenance

- A. lubrication - types and grades
- B. other fluids - antifreeze, freon
- C. belt, chain and clutch tensions
- D. cutting edge renewal
- E. equipment maintenance (tillage, harvesting equipment, landscape equipment)

IV. Repair

- A. steam clean or power wash
- B. bearing types and applications
- C. oil seals and gaskets
- D. hydraulic components (hoses, valves, cylinders)
- E. belts, chains or gauges
- F. brake components
- G. clutch parts
- H. tire and tube repair or replacement
- I. cutting edge

V. Storage

- A. develop a schedule for storage
- B. review manuals for storage procedures
- C. cleaning procedures

TEACHER ACTIVITIES:

1. Use lectures and demonstrations to present information on safe use of equipment and tools.
2. Provide equipment, supplies and reference materials.
3. Plan a visit to a local agricultural business to witness repair and maintenance procedures.
4. Plan a visit to an equipment dealer.
5. Supervise individual or group repair projects.

STUDENT ACTIVITIES:

1. Visit local agriculturalists and equipment dealers.
2. Inventory local area repair shops for agricultural equipment.
3. Identify sources of supplies for repairs.
4. Set up a machine repair schedule for an agricultural business.
5. Perform repair skills on at least one agricultural machine.
6. Prepare a machine for proper storage.
7. Record skills and time spent on individual shop projects.

EVALUATION:

1. Evaluate projects using shop evaluation criteria.
2. Evaluate inventory, source of supply and skill sheets.

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2. Bibliography -

C. ADDITIONAL AND UPDATED RESOURCES INCLUDING ADDRESSES AND PHONE NUMBERS:

1. Resources

Address

Phone

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Agricultural Structures

LENGTH: Six weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 or 12

OBJECTIVES: The students will be able to:

1. Determine and demonstrate safe work habits while working in the building environment.
2. Check for existing laws and regulations regarding construction and how to obtain the necessary building permits.
3. Develop a location map.
4. Develop a plot plan.
5. Choose the most appropriate site for the building.
6. Select or develop plans which meet the needs of the builder.
7. Utilize charts, tables, and suggested space requirements for animals, machinery, feed and equipment.
8. Determine the appropriate foundation for the structure.
9. Identify and determine the framing system to be used.
10. Identify and determine the various sub-assemblies and systems which will be needed to build the structure.
11. Develop the appropriate electrical, heating, plumbing, and ventilation plans as required.
12. Estimate and prepare a bill of materials and cost estimate.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanics	288:1(a-k), 288:2(a-j), 288:3(a), 289:3(b-f), 289:4(a-n), 289:5(a-i), 291:9(a-n), 294:18(a-j), 295:18(k-p), 295:20(a-u), 295:21(a, b), 296:21(c-j), 296:24(a-d), 297:24(e), 297:25(a-e)
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CONTENT:

I. Safety

- A. proper clothing
- B. appropriate safety apparel, glasses, gloves, boots etc.
- C. OSHA required safety fixtures, scaffolding etc.

II. Needs and uses of agricultural structures

- A. livestock housing
- B. storing machinery
- C. storing harvested crops
- D. storing perishable products
- E. growing plants
- F. storing, displaying and selling products
- G. special needs...milk room, chemical storage, etc.

III. Basic types of construction

- A. post and beam
- B. pole frame
- C. clear span
- D. one story vs. multiple story

IV. Principles of planning farm buildings

- A. arranging to utilize all space
- B. selection and placement of tools and equipment to fit workers conveniently
- C. combine and/or eliminate nonproductive chores
- D. centralize related jobs that require similar equipment and tools
- E. flexibility and utilization of machinery vs. personpower
- F. awareness of aesthetics, environmental conditions, neighbors, safety, labor efficiency and cost effectiveness

V. External services, utilities, and traffic - physical features

- A. surfaced roads or driveways
- B. accessible for pick up and deliveries
- C. electricity available
- D. water availability
- E. fire protection
- F. convenience for machinery operation
- G. wastes and sewage disposal
- H. drainage and/or flooding
- I. soil type
- J. air circulation and/or wind patterns
- K. snow fall amounts
- L. depth of average frost line

VI. Common Design Terms

- | | |
|----------------------|--------------------------|
| A. force | J. safety factors |
| B. unit pressure | K. strain |
| C. total pressure | L. modules of elasticity |
| D. load | M. section modules |
| E. compression force | N. bending moment |
| F. tension force | O. on center |
| G. unit stress | P. cantilever beams |
| H. allowable stress | Q. simple beams |
| I. shear stress | R. continuous beams |

VII. Types of loads on structures

- | | |
|----------|---------------|
| A. live | E. wind |
| B. dead | F. fluid |
| C. floor | G. semi-fluid |
| D. snow | |

VIII. Wood selection for structures

A. characteristics

1. lightweight
2. readily available and handled easily
3. wide range of adaptability for many uses
4. relatively inexpensive

B. factors affecting election

- | | |
|---------------|----------------|
| 1. appearance | 6. shakes |
| 2. durability | 7. checks |
| 3. strength | 8. waves |
| 4. defects | 9. cross grain |
| 5. knots | 10. decay |

C. stresses in woods

D. nail holding strength

E. hardness

F. strength in posts for landscape needs of family

G. bending strength

H. species of common woods

- | | |
|-------------------------------|--------------------|
| 1. Douglas Fir | 9. Eastern Hemlock |
| 2. Idaho White Pine | 10. Oaks |
| 3. Lodgepole | 11. Maples |
| 4. Canadian or Eastern Spruce | 12. Beeches |
| 5. Western Larch | 13. Birches |
| 6. Western Hemlock | 14. Longleaf Pine |
| 7. Western Red Cedar | 15. Shortleaf Pine |
| 8. White Fir | |

I. lumber measurement, terms and specifications

1. board feet is unit used
2. common boards 1"T x 2"W or wider
3. light framing 2"T x 4"W
4. joists and planks 2"-4"T x 6"W or wider
5. beams and stringers 5" or more T 2" or more W
6. posts 5" x 5" and larger
7. timbers less than 2" wider than thick
8. dimension lumber - any 2" or over thick

J. grades of lumber

1. yard, hardwoods and structural
2. finish
 - select
 - B and better clear
 - C select
 - D select
3. sheathing and forms
 - No. 1 common
 - No. 2 common
 - No. 3 common
 - No. 4 common
 - No. 5 common

K. types of treated wood - preservatives

1. three classes
 - oil - borne
 - water - borne
 - water - repellent
2. oil - borne
 - b. creosote
 - c. penta
3. water - borne - 30 commercial types
 - a. LP-22 - Use below and above ground
 - b. LP-2 - use above ground only
4. water repellent
 - a. usually used for window sashes and doors

IX. Framing systems

A. footing

B. foundation

C. walls

1. wood
2. metal
3. masonry

X. Roof styles

- | | |
|----------------|---------|
| A. combination | D. hip |
| B. gable | E. shed |
| C. gambrel | F. flat |

XI. Roof truss - rafter designs

- | | |
|--------------|-----------------|
| A. belgian | D. queen post |
| B. flat | E. scissors |
| C. king post | F. single slope |

XII. Columns

- A. wood
- B. masonry
- C. steel

XIII. Roofing

- A. wood shingles
- B. composition asphalt
 - 1. roll
 - 2. shingles
 - 3. build-up

XIV. Plywood types

- A. exterior
- B. interior

XVI. Fasteners

- A. nails
 - 1. common
 - 2. box
 - 3. casing
 - 4. spikes
- B. lag screws
- C. bolts
- D. split ring connectors
- E. glue

XVI. Concrete

- A. characteristics
 - 1. decayless
 - 2. molds easily to shape

3. clean and sanitary
4. fireproof
5. resists termites and rodents

B. ingredients

1. portland cement
2. coarse aggregate
3. fine aggregate
4. water

C. concrete making steps

1. select materials
2. proportion mixture
3. mix ingredients
4. place concrete in form
5. finish
6. cure

D. special conditions

1. freezing
2. extreme heat

E. reinforced

F. concrete masonry

1. types

- a. standard
- b. lightweight

2. units

- a. blocks - 4, 6, 8, 10, 12" W x 4 and 8" H
- b. pilasters
- c. lintels
- d. tilt-up

H. mortar

XVII. Insulation

A. types

1. loose fill
2. blanket
3. batt
4. rigid
5. reflective

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1. Resources	Address	Phone
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D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

B. vapor barriers

1. metallic foils
2. asphalt-impregnated paper
3. polyethylene plastic
4. enamel and oil base paints

C. heat loss types

1. conduction
2. convection
3. radiation

D. terms used in selecting insulation

1. British thermal unit
2. thermal conductance
3. thermal conductivity
4. thermal resistance
5. thermal resistivity
6. thermal transmittance

XVIII. Carpentry tools

- A. brace and auger bits
- B. power drill and drills
- C. cross cut saw
- D. rip saw
- E. finish saw
- F. key hole saw
- G. wood chisels
- H. jack plane
- I. block plane
- J. set of assorted screwdrivers
- K. claw hammer
- L. ripping hammer
- M. combination square
- N. framing square
- O. portable electric drill - drill set
- P. portable electric saw - assorted blades
- Q. portable electric saber saw - assorted blades.

XIX. Protection

- A. accident insurance
- B. liability insurance
- C. durable work clothes
- D. steel toe shoes
- E. leather gloves
- F. safety glasses
- G. review of safety rules
- H. security

AGRIGULTURAL MECHANICS CURRICULUM

UNIT: Agricultural Surveying

LENGTH: Four weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 and 12

OBJECTIVES: The students will be able to:

1. Identify the various types of survey levels and target rods.
2. Identify the parts of the survey level and its use.
3. Set up and properly level the survey instrument.
4. Demonstrate the ability to record field notes.
5. Demonstrate the ability to calculate elevations and distances.
6. Calculate pace and measure land within an acceptable amount of error.
7. Correctly define survey terms.
8. Demonstrate how to care for and safely move instrument from point to point.
9. Demonstrate the ability to use the survey equipment.
10. Calculate areas of a field (acreage).

RELATED JOB TITLES AND RELEVANT COMPEIENCIES:

Production Agriculture Mechanic	288:2(j), 288:3(a), 289:3(b-f), 295:21(a-b), 296:21(c-j), 296:22(g), 296:23(j)
Irrigation Technician	323:3(d)

CONTENT:

I. Units of Measurement

- | | |
|----------------|---------------|
| A. foot | F. cubic yard |
| B. square foot | G. chain |
| C. cubic foot | H. rod |
| D. yard | I. mile |
| E. square yard | J. acre |

II. Distance determination

- A. pacing
- B. chaining
 - 1. head chainperson
 - 2. rear chainperson

III. Field Notebook

- | | |
|-------------------------|----------------------|
| A. bench mark | F. survey party |
| B. back sight | G. weather condition |
| C. height of instrument | H. date -- time |
| D. foresight | I. location |
| E. elevation | J. turning point |

IV. Types of surveys

- A. topographic survey
- B. computer aided survey

V. Types of leveling

- A. differential leveling
- B. profile leveling
- C. hand leveling

VI. Types of levels

- A. builders level
- B. farm level
- C. transit level

VII. Types of Rods

- A. positive reading
- B. direct reading
- C. metric, engineers, architect scales

VIII. Setting up the instrument

- A. safety - care of the instrument
- B. leveling technique -- tripod and instrument

IX. Field work and laboratory exercises

TEACHER ACTIVITIES:

1. Explain and demonstrate the mathematical formulas used in computing areas and volumes.
2. Pace and measure a given distance and set starting and ending points.
3. Demonstrate the use of the chain and discuss the head chainperson's and rear chainperson's responsibility.
4. Demonstrate the use of calculators and computers in determining a given area after all chaining has been completed.
5. Demonstrate how to correctly handle and set up the transit-level and the use of the four leveling screws.
6. Allow students an opportunity to focus and sight through the level.
7. Demonstrate the correct method of holding the sighting rod and how to read the rod with accuracy.
8. Demonstrate how to set up a field notebook, enter reading and compute differences in elevations.
9. Demonstrate a differential elevation exercise, enter readings into notebook and compute all readings.
10. Discuss the use of topographical maps and how they are made.
11. Have students locate a particular point on topographical map such as home, school, church, town hall.
12. Demonstrate the use of a hand tool level for running contour lines.
13. Set up level to determine pipe pitch.
14. Set up level to determine pitch for a road, parking area and barn yard.
15. Demonstrate computer aided topographical surveys and other computer aided software.

STUDENT ACTIVITIES:

1. Keep a notebook of pacing measurements.
2. Calculate area of a given field using formulas and calculators.
3. Measure a given area using appropriate measuring tools.
4. Set up and level the transit.
5. Enter and compute backsight, foresight and differences in elevations.

6. Calculate and grade area for optimum drainage using transit and rod.
7. Set drainage pipe with recommended pitch using transit and/or hand level.

EVALUATION:

1. Quizzes and tests.
2. Field notebooks and accurate math calculations.
3. Actual drainage and pipe laying to specifications.

RESOURCES:

1. Transit and rod.
2. Gunther chain and 100' tape.
3. Range poles.
4. Field notebooks.
5. Plastic drainage pipe.
6. Computer.

BIBLIOGRAPHY:

References:

California Vocational Agriculture Guidelines Instructional Unit for Surveying.

Department of Agricultural Education, Ohio State University, 1972, IV Surveying.

Use of the Level, Setting Up the Instrument VEP, California Polytechnic State University, San Luis Obispo, CA 98407 d 937.

Surveying Field Notes, New York State College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14853.

Student Activity Manual, Leveling and Land Measurement Practices for Agriculture, Clinton O. Jacobs, Department of Agricultural Education, University of Arizona, Tucson, Arizona.

Surveying, 5 videos, filmstrips or sound slide programs, Vocational Media Associates, Box 1050 Mount Kisco, NY 10544-0050.

Elementary Surveying, 6th Edition, Russell C. Brinker, Paul R. Wolf Harper & Row Publishers, 10 East 53rd Street, New York, NY 10022.

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Address

Phone

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Agricultural Waste Management

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 or 12

OBJECTIVES: The students will be able to:

1. Identify the laws relating to waste disposal.
2. Identify types of agricultural wastes.
3. Identify the composition and value of agricultural waste.
4. Explain methods of handling agricultural waste.
5. Identify safety concerns of agricultural wastes.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic 288:3(a), 289:3(b-f), 295:20(b, c, d,
e, f, j, k, m, n, o, u)

CONTENT:

- I. Types of agricultural waste
 - A. livestock
 - B. processing plant
 - C. chemical
 1. herbicides
 2. pesticides
 - D. petroleum product
- II. Safety
 - A. safety concerns
 - B. public interest
 - C. public health laws
 - D. hazardous waste concerns

III. Amounts and concentrations

A. daily production of various waste products

B. properties of waste

C. concentrations:

1. beneficial substances in wastes
2. hazardous substances in wastes

IV. Agricultural waste management

A. methods of handling for each type of agricultural waste

1. consider the alternatives for type of agricultural waste
2. meet legal requirements
3. choose a system that will do best in a given situation
4. use resource people and tools available
5. collect wastes
6. transport wastes
7. separate wastes
8. store wastes

B. handling specific types of wastes

1. solid animal wastes

- a. stockpile and haul
- b. composting
- c. dehydration
- d. incineration

2. liquid animal waste

- a. stabilization ponds
- b. activated sludge processes
- c. anaerobic digestion
- d. aerobic digestion
- e. haul to field
- f. slurry tanks
 - 1) under ground
 - 2) above ground
- g. picket dam drains
- h. gravity flow manure storage area

3. processing plant wastes

- a. types of wastes
- b. specific storage, handling and disposal requirements for each type of waste set by Federal, State and local governments

4. chemical wastes
 - a. types of wastes
 - b. specific storage, handling and disposal requirements as set by the Federal, State and local governments
5. petroleum product wastes
 - a. types of wastes
 - b. specific storage, handling and disposal requirements as set by the Federal, State and local governments
6. dead animal disposal

V. Career Opportunities

TEACHER ACTIVITIES:

1. Arrange field trips.
2. Secure health officials, cooperative extension agents, soil conservation service personnel and waste management equipment manufacturers and dealers as guest speakers.
3. Use lecture and discussion periods to cover theory of unit content.
4. Provide laboratory sheets, materials, references and exams to accomplish objectives.
5. Provide water/soil test kits.

STUDENT ACTIVITIES:

1. Maintain a notebook.
2. Complete work assigned.
3. Participate in classroom activities.
4. Attend field trips.
5. Participate in practical and written exams.
6. Develop questions to pose to guest speakers.
7. Develop projects to show proper agricultural waste management systems.
8. Make a compost.
9. Test water/soil for agricultural wastes.

EVALUATION:

1. Quizzes and written exams on all material.
2. Notebooks and laboratory sheets will be evaluated.
3. Questions for guest speakers will be evaluated.

RESOURCES:

1. Reference material.
2. Surrounding farms, agricultural processing plants, nurseries and greenhouses for field trips.
3. Milkplant Field Inspectors.
4. Federal, State and local land use officials. (Town Hall, City Hall)
5. Cooperative Extension Service.
6. Soil Conservation Service, USDA.
7. Agricultural waste management equipment manufacturers and dealers.

BIBLIOGRAPHY:

References:

Northeast Regional Agricultural Engineering Service (NRAES)

"Dairy Manure Management: Planning" - Order - NDPC 27.1

"Dairy Manure Management: Land Application" - Order - NDPC 27.2

"Dairy Manure Management: Liquid Manure Storage" - Order - NDPC 27.3

"Dairy Manure Management: Semi-Solid Manure Storage" - Order - NDPC 27.4

"Dairy Manure Management: Gravity Manure Handling" - Order - February, 1980 10M

Agricultural Conservation Program, Litchfield County ASCS Office, P.O. Box 276, Litchfield, CT 06759 567-8457

WP-4 "Animal Waste Control Facilities" - this practice is designed to provide facilities for the storage and handling of livestock and poultry waste

AVI Publishing Company, Inc., Westport, CT. 1981

Managing Livestock Wastes; Merkel, James A., Ph.D.

Food Processing Waste Management; Green and Cramer

Principles of Animal Environment; Esmay

Cornell Instruction Materials Service, Department of Education,
Cornell University, 24 Roberts Hall, Ithaca, New York 14853-5901
(607) 255-9252

C 501F "Agriculture and the Environment"

C 503F "Agriculture and the Ecosystem"

C 505F "Plant Nutrients in the Environment"

Mid-West Plan Service Catalog, 122 Davidson Hall, Iowa State
University, Ames, Iowa 50011

AED-18 "Selecting Dairy Manure Handling Systems" .50

MWRS-18 "Livestock Waste Facilities Handbook" \$4.00

VIS-18 Visual aid for the above title \$5.50

MWPS-25 "Research results in manure digestion runoff; refeeding
and ordors" \$4.00

AED-23 "Outside Liquid Manure Storages" \$1.50

MWPS-74303 "Liquid manure tanks - rectangular below ground" \$1.50

Agricultural Mechanics: Fundamentals and Applications, Elmer L.
Cooper, Delmar Publishers: Marketing Services, 2 Computer Drive
West, Box 15015, Albany, NY 12212-9985

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1. Resources

Address

Phone

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Alternate Energy

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 and 12

OBJECTIVES: The students will be able to:

1. List several types of alternate energy.
2. List economic reasons for alternate energy.
3. Define passive construction design.
4. List practical applications of alternate energy.
5. Read and explain necessary information as assigned.
6. Organize a list of temperature recorders.
7. Utilize safety skills.
8. Evaluate projects as it could relate to other fields of agriculture for heat.
9. Construct a model of alternate energy.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Plant Electrician	349:1(a-h), 350
Instrument Technician	353:2(a, d, e, g, h, i), 354:2(k-l)
Plant Maintenance Mechanic	3357:1(a-h), 357:2(a-i), 358:2(j-oo), 358:3(a-j)

CONTENT:

I. Energy sources

- | | |
|---------------|-----------------------|
| A. solar | F. wood |
| B. wind | G. body |
| C. water | H. chemical (battery) |
| D. electrical | I. animal waste |
| E. coal | |

II. Distributive systems

- A. passive
- B. stoves, fireplaces, furnaces, boilers
- C. heat pumps
- D. solar cells
- E. hydraulic ram

III. Influencing factors

- | | |
|-----------------------|--------------------------------|
| A. storage systems | G. wind breaks and landscaping |
| B. solar cells | H. color |
| C. insulating factors | I. latitude and season |
| D. weather stripping | J. air movement |
| E. ventilation | K. location |

TEACHER ACTIVITIES:

1. Present information on alternate energy.
2. Pre-order various bulletins and articles.
3. Prepare a list of possible areas for field trips.
4. Provide necessary materials for work area and safety equipment.
5. Provide working drawings for construction of a student project.
6. Provide student with proper equipment.
7. Provide a source for additional reading and advanced ideas.
8. Students set up a display of alternate energy ideas at local fairs, shopping centers.
9. Student take inventory of energy usage at home and farm/work area.

STUDENT ACTIVITIES:

1. Prepare notebook.
2. Collect bulletins and articles dealing with alternate energy.
3. Attend field trips.
4. Complete alternate energy project.
5. Follow safety procedures.
6. Keep necessary records.
7. Interpret and evaluate records.
8. Set-up displays when appropriate.
9. Take inventory of home/farm/work area.

EVALUATION:

1. Grade notebooks and literature.
2. Grade alternate energy project.
3. Class quizzes and examinations.
4. Class participation.
5. Evaluate field trip - written report by each student.

RESOURCES:

1. Shop and classroom areas.
2. Shop tools and equipment.
3. Textbooks, bulletins and newspapers.
4. Shop supplies.
5. Field trip area.
6. recording equipment.
7. Areas for placement for display areas.

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Charlotte, Vermont

Noll, Edward M., Wind/Solar Energy, Howard W. Sams and Co., Inc.,
Indianapolis, IN

Passive Design Ideas for the Energy Conscious Builder, National
Solar Heating and Cooling Information Center, Rockville, MD

Passive Solar Living, Northeast Utilities, Box 270, Hartford, CT
06141

Solar Hot Water, Northeast Utilities, Box 270, Hartford, CT 06141

Sullivan, George, Wind Power For Your Home, Cornerstone Library,
New York, NY

Vidich, Charles, Protecting Solar Access: Tips for Builders and
Homeowners, Northeast Utilities, Box 270, Hartford, CT 06141

Vidich, Charles, Passive Solar Subdivision Design: Tips for Developers, Builders and Site Planners, Northeast Utilities, Box 270, Hartford, CT 06141

Whitaker, James H., Agricultural Buildings and Structure, Reston Publishing Co., A Preston-Hall Co., Reston, VA

MEDIA:

Collecting and Storing Solar Energy, (Slides), Vocational Agriculture Service, University of Illinois, 1401 South Maryland Drive, Urbana, IL 61801

Determining which practices are most efficient and Installing Materials, (Slides), Ohio Agricultural Education, Curriculum Materials, Room 254, 2120 Fyffe Road, Ohio State University, Columbus, OH 43210-1099

Energy Challenges and Choices, Part I & II, Energy Use and Supply and Home Energy Management, (Slides) Vocational Agriculture Service, University of Illinois, 1401 South Maryland Drive, Urbana, IL 61801

Installing Solar Systems, (Video), Vocational Media Associates, P.O. Box 1050, Mount Kisco, NY 10549-0050

Introduction to Solar Energy, (Video), Vocational Media Associates, P.O. Box 1050, Mount Kisco, NY 10549-0050

Passive Soalr House Design, (Filmstrip), Bergwall Productions, Inc., P.O. Box 238, Garden City, NHJ 11530-0238. Describes need for energy efficient home.

Understanding and Practicing Energy Conservation in Buildings, (Slides), Ohio Ag Education, Curriculum Materials Service, Room 254, 2120 Fyffe Road, Ohio State University, Columbus, OH 43210-1099

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1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Concrete for Farm and Home Use

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 and 12

OBJECTIVES: The students will be able to:

1. Determine what safety precautions are necessary while working with concrete and masonry products.
2. Determine the application for the concrete (floors, walls, patio, steps, silo, etc.).
3. Determine the compressive strength for concrete (3000, 2500, 4000, etc.).
4. Select the proper materials for mixing concrete - size of the aggregates, type of portland cement, sand.
5. Calculate the volume of concrete necessary for the job.
6. Construct and treat forms.
7. Mix concrete with proportional amounts of water using a small mixer.
8. Place, screed, and float concrete to the desired texture.
9. Place or embed fasteners into concrete.
10. Maintain and properly clean concrete mixing equipment and tools.
11. Calculate cost of concrete and various materials.
12. Compare handmixing concrete and delivery by redimix truck.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288:1(a, b, d), 291:9(a-n), 295:20(u), 296:22(h, i, j), 293:23(f), 296:24(a-d), 297:24(e)
Plant Maintenance Mechanic	357:1(a-h), 358:2(kk), 358:3(a, b, c, d, e)

CONTENT:

I. Selecting materials and proportioning materials

- A. types of portland cement I, II, III, etc.
- B. aggregates -- types and sizes
- C. water and water quality
- D. select the proper cement-water ratio for the job
- E. determine cement-sand-stone ratio

II. Site Preparation

- A. soil conditions
- B. slope
- C. boundaries
- D. drainage

III. Form construction

- A. materials used for form construction
- B. bracing, reinforcement wire, sonatubing
- C. pressures exerted on forms
- D. treating forms for removal
- E. expansion joints and dummy joints
- F. vapor barriers

IV. Estimating concrete volume

- A. formula for determing volume
- B. compare home mixing vs. redi mix

V. Placing concrete

- A. screeding
- B. vibrating concrete/vibrator use

VI. Finishing concrete

- A. methods
- B. finish desired

VII. Curing concrete

- A. resaons for curing
- B. methods of curing
- C. special conditions
 - 1. cold weather
 - 2. hot weather

VIII. Masonry

- A. concrete block
 - 1. sizes, styles, types
 - 2. applications
- B. brick
 - 1. styles, texture, types
 - 2. applications
 - 3. patterns

C. mortar

1. water-sand-mortar ratio
2. mixing procedure

D. procedure for laying block and/or brick

1. corners
2. straight wall

E. materials

- | | |
|---------------|------------------------|
| 1. level | 5. mixer |
| 2. mortar tub | 6. line level |
| 3. mortar hoe | 7. corner block/string |
| 4. trowels | |

TEACHER ACTIVITIES:

1. Introduce unit.
2. Discuss safety precautions necessary when working with concrete.
3. Provide worksheets for lab exercises.
4. Demonstrate and discuss aggregate sizes and conditions of sand and water.
5. Demonstrate construction and oiling of forms and proper placement.
6. Demonstrate proper proportioning and mixing of all materials.
7. Demonstrate proper placement of concrete into forms and screeding.
8. Demonstrate finishing techniques, edging, brooming and troweling.
9. Demonstrate proper curing techniques.
10. Arrange a field trip to a red-mix concrete plant.
11. Demonstrate masonry block construction.

STUDENT ACTIVITIES:

1. Complete worksheet and calculate concrete volume practice sheets.
2. Select and proportion aggregates and water for a small concrete project.
3. Construct and oil forms -- insert reinforcing wire when applicable.
4. Mix and place concrete into forms.
5. Screed and trowel and edge concrete.
6. Cure concrete.

EVALUATION:

1. Test and quizzes.
2. Evaluate concrete projects/masonry projects.
3. Evaluate worksheets and notebooks.

RESOURCES:

1. Local Redi-Mix contractor.
2. Local building supplier.
3. Instructional manual for mixer and other hand tools.
4. Tools, bull float, hand float, broom, power trowel, edger.

BIBLIOGRAPHY:

References:

Portland Cement Association, 33 West Grand Avenue, Chicago, IL,
Concrete Technology Instructor Guide.

Dalzell, J. Ralph, Concrete Block Construction, American Technical
Society, Chicago, IL.

Hoerner, Thomas A., Quality Concrete Construction, Hobar
Publication, St. Paul, MN.

Portland Cement Association, 33 West Grand Avenue, Chicago, IL,
Making Quality Concrete for Farm Construction.

AUDIO VISUAL MEDIA:

Instructional Materials Service, 24 Roberts Hall, Cornell
University, Ithaca, NY 14853-5901, "Mr. Quality Concrete".

Ohio Vocational Agriculture Service, Curriculum Materials Service,
Room 254, 2120 Fyffe Road, Ohio State University, Columbus, OH
43210-1099, "Concrete Masonry, Farm Construction" 55 slides

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2. Teacher Activities --

3. Evaluation Methods -

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1. Media -

2. Bibliography -

C. ADDITIONAL AND UPDATED RESOURCES INCLUDING ADDRESSES AND PHONE NUMBERS:

1. Resources	Address	Phone
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D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Diesel Fuel Systems

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 or 12

OBJECTIVES: The students will be able to:

1. Demonstrate safe working practices.
2. Compare the diesel engine to the gasoline engine and state principles of operation.
3. Identify components of a diesel fuel system and state the operational function of each component.
4. Identify types of combustion chambers and fuel systems.
5. Explain the importance of fuel filters in a diesel fuel system.
6. Identify the different types of nozzles.
7. Use special tools to service and test nozzles.
8. Identify injection pumps.
9. Demonstrate use of operator's and service manuals.
10. Do maintenance service.
11. Remove and replace injection pump and time pump.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288:1(a-k), 291:10(a-m), 291:11(a-j), 292:11(k-w)
Tractor Mechanics Helper	302:2(a-b), 303:3(c-t), 304:11(a-v), 305:12(a-q)

CONTENT:

I. Safety

- A. eye protection
- B. hand, face and body protection
- C. safe use of air tools
- D. safe use of cleaning solvents and fuels
- E. hand tool safety

II. Compare diesel engine to gasoline - explain increased use

- A. 2 and 4 cycle
- B. mechanical components
- C. fuel introduction
- D. compression ratios
- E. demonstrate compression tests

III. Types of combustion chambers

- A. direct
- B. precombustion
- C. turbulence
- D. energy cell

IV. Explain system requirements

- A. meter
- B. atomize
- C. distribute
- D. quantity
- E. timing

V. Type of pump

- A. unit injector
- B. inline type pump
- C. distributor type pump
- D. transfer pump

VI. Identify types of injection systems

- A. common rail
- B. accumulator
- C. jerk pump

VII. Identify types of nozzles

- A. pintle
- B. pintaux
- C. hydraulic (differential pressure)
- D. multihole
- E. pencil
- F. poppet

VIII. Test nozzle

- A. opening pressure (pop off)
- B. spray pattern
- C. leakage test
- D. back leakage test
- E. safety precautions when testing

IX. Disassembly of nozzles and study component

X. Cleaning nozzle

- A. cleaning equipment
- B. cleaning procedure
- C. reassembly and adjustments
- D. retest
- E. reinstall - torque procedures

XI. Installation of filters

XII. Bleeding of fuel system

TEACHER ACTIVITIES:

1. Teach safety practices.
2. Use lectures to present main objectives.
3. Demonstrate disassembly and assembly of pumps, nozzles and other components.
4. Provide components - for student use.
5. Demonstrate use of special tools.
6. Remove, replace and time injection pump.

STUDENT ACTIVITIES:

1. Students will keep accurate notebooks of records, diagrams, and points of information.
2. Students will complete worksheets and assignments.
3. Students will use technical service manuals.
4. Students will disassemble and assemble injector nozzles, and inspect for wear and damage.
5. Students will remove and replace injection pumps and time properly.

EVALUATION:

1. Observation of students' work.
2. Student response to questions.
3. Completion of worksheets.
4. Safety habits.
5. Quizzes and examinations.
6. Students' ability to use tools, identify parts, adjust, etc.

7. Attitudes toward completion of assignments and carry out responsibilities.

RESOURCES:

1. Vocational agricultural mechanics shop tools.
2. Diesel tractor or engine.
3. Components - injectors, pumps, filters.
4. nozzle tester.

TEXT:

1. Conklin, Glen, Diesel Fuel Systems, Principles and Service, Instructional Materials Service, Cornell University, Ithaca, New York.
2. Fuels and Lubricants, Athens, GA AAVIM
3. Fundamentals of Service - Engines, John Deere Service Publication, Moline, Illinois 61265

REFERENCES:

1. Red Book, Technical Publications, Kansas City, Missouri, Operations Manuals.
2. Instructional Material Service, Cornell University, Ithaca, New York.
3. Technical Publications, Kansas City, Missouri, Caterpillar Corp., H. O. Penn, Newington, CT.

MEDIA:

1. Filmstrip - Lubrication, Colonial Films, Tractor Fuels and Lubrication, Part I & II, Colonial Films.
2. Overhead Transparencies - John Deere - Engines.
3. Videos - John Deere-Clean Air, Efficient Cooling, Lubrication, Clean Fuel (Set of 4).
4. Diesel Maintenance - Kubota.

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D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Electric Motors and Controls

LENGTH: Six weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 and 12

OBJECTIVES: The students will be able to:

1. Demonstrate safe procedures when working with electronic motors and controls.
2. Define the principles of electricity and electric motors.
3. Identify the component parts of the electric motor.
4. Identify different types of electric motors.
5. Interpret a motor name plate.
6. Wire and change leads of an electric motor.
7. Maintain different types of electric motors.
8. Select proper motor for the job.
9. Identify types of electrical controls.
10. Select a type of control for a specific purpose.
11. Read and follow directions of a schematic on available controls.
12. State the problems involved in replacing and changing controls.
13. Operate the different types of controls available.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Set-up Mechanic of Farms	298:1 (e), 301:7 (h)
Industrial Equipment	
Production Agriculture Mechanic	291:10 (f, g, i, l, m), 291:11 (a, b, c, e, h, l, m, n, o, p, s, v), 293:14 (j, l), 294:18 (a-p), 295:19 (a-h)
Plant Maintenance Mechanic	357:2 (jj)
Instrument Technician	353:1 (a-e), 353:2 (b, d, e, f, g, h, i, j, n, o, p, q), 354:3 (a-f)
Irrigation Technician	322:2 (a-e), 322:2 (c, d, e), 323:4 (a, b, c, d), 324:7 (a-e)
Plant Electrician	349:1 (a-h), 349:2 (a-j), 350:2 (k-x), 350:3 (a-i)

CONTENT:

- I. Safety
 - A. proper use of safety glasses
 - B. correct procedures in wiring to meet electrical code
 - C. safety devices
- II. Review basic electricity
 - A. generation and magnetism
 - B. volts, amps, watts, and kilowatts
 - C. wire sizes and fusing
 - D. circuits and polarization
- III. Motor operation
 - A. operating principles
 - B. interaction of parts
- IV. Motor parts
 - A. rotor
 - B. stator
 - C. switches
 - D. leads
 - E. housings
 - F. bases
- V. Selection of proper motor
 - A. split phase
 - B. capacitor
 - C. repulsion-induction
 - D. universal
 - E. 3-phase
- VI. Motor control and protection
 - A. changing direction
 - B. changing voltages
 - C. circuit breakers, fuses, thermal protection
- VII. Maintenance procedures
 - A. proper installation
 - B. oil, dust, moisture
 - C. trouble shooting and repair

VIII. Electrical controls

- A. need, use and terms involved with electric motor controls
- B. polarization and lead wires
- C. reading and following schematics
- D. types of controls to be wired
 - 1. heater
 - 2. limit
 - 3. pressure
 - 4. temperature
 - 5. humidity
 - 6. photoelectric
 - 7. timing
 - 8. magnetic

TEACHER ACTIVITIES:

- 1. Present safety rules and procedures.
- 2. Discuss and review basic electricity.
- 3. Discuss types of motors and have units available to point out the differences.
- 4. Demonstrate where the different types of motors would be used.
- 5. Discuss parts of electric motors, showing the parts as they are discussed, as well as describing motor operation and interaction of the parts.
- 6. Demonstrate how to change the direction of flow of electricity in order to change direction of rotation of motor, discuss why and under what conditions you would want to reverse direction.
- 7. Demonstrate how to maintain an electric motor and the importance of proper maintenance.
- 8. Take a field trip to observe motor maintenance and repair.
- 9. Show and discuss types of controls available and their applications.
- 10. Observe and supervise student activities to insure proper skill development.

STUDENT ACTIVITIES:

1. Keep a notebook of handout materials and class notes.
2. Diagram how to change direction of flow of electricity in order to change direction of rotation of motor.
3. List parts and how to identify them.
4. List steps for proper maintenance.
5. Study available motors and be able to describe the operation and interrelation of all parts.
6. Wire motor to reverse direction of rotation.
7. Wire motor with a safety device to prevent overload.
8. Carry out maintenance steps on different motors.
9. Maintain motors at home or on the job.
10. Develop pictorial notebook of controls and specifications which apply to selected controls.
11. Select types of controls for a specific job.
12. Read and follow directions of schematic on available controls.
13. Identify internal components of available controls.
14. Wire and operate specific controls.

EVALUATION:

1. Quizzes
2. Monitor student skill development.
3. Evaluate student application of knowledge of electric motors on the job.
4. Pictorial notebook.
5. Questions to be answered after completion of each exercise.
6. Evaluate students ability to select proper control in a given situation and wire it correctly.

RESOURCES:

1. School shop.
2. Common tools used on electric motors.
3. Collection of electric motors and parts.
4. Contact area businesses for field trips.
5. Demonstration board of electric motor components.
6. Connecticut Electrical Controls Kit
The kits can be obtained by contacting the Rockville, Middletown or Woodbury Vocational Agriculture Centers.
7. Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112
 - a. Electrical and Basic Control Kit
 - b. Electrical Motor Tool Kit

BIBLIOGRAPHY:

References:

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112

Electric Motor Control, - 3rd Edition - Lab manual and instructors guide available.

Electric Motors-Instructors Manual, - 1983

Electric Motors-Principals, Controls, Services and Maintenance, 1983

Electric Motors Worksheets, set of 20 worksheets covering types, parts, basic principles, use of meters maintenance, reversing and nameplate information.

Instructional Materials Service, 24 Roberts Hall, Cornell University, Ithaca, NY 14853-5901

Electric motors for Farm Use - covers selecting electric motor types and sizes, installation and care along with practical shop exercises. 30 pages.

Cleaning and Servicing Electric Motors - lists procedures and materials needed.

Phipps, Lloyd J., Farm Merchants Text and Handbook, The Interstate Printers and Publishers, P.O. Box 50, Danville, IL 61834-0050.

Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 South Maryland Drive, Urbana, Illinois 61801

Applying Electrical Controls in Farm Production - 12 pages

Installing and Caring for Electric Motors in Agriculture - 50 pages

Selecting Electric Motors for Use in Agriculture - 24 pages

Student Exercises for Controls Kit - 50 pages

Suggestions to Teachers for Electrical Controls Kit

Using 3-phase Electrical Power on the Farm

MEDIA:

Bergwall Productions, Inc., P.O. Box 238, Garden City, NY 11530-0238

DC Motors - 5 filmstrips with 5 cassettes and study guide, covers:

principles of operation I and II; identifying armature and fields; measuring motor resistance counter electromotive force.

3-Phase AC Motors - 4 filmstrips with 4 cassettes and study guide, covers:

squirrel-cage induction motors I and II; across the line starter; reversing magnetic starters

Motor Control Fundamentals - 1) 5 filmstrips with 5 cassettes and study guide, covers:

line diagrams and electrical symbols; interpreting complex line diagrams; reduced voltage starters; part winding and wye-delta starter; jogging, braking and plugging.

Single Phase AC Motors - filmstrips with 4 cassettes and study guide, covers:

split phase induction motor; capacitor induction motor; repulsion-type motor; universal motor

Solid State Motor Control - 5 filmstrips with 5 cassettes and study guide, covers:

static logic; and, nor and memory; time delay and converters; logic design and application; applications and installation.

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112

Alternating Current Electric Motors - 37 slides and 10 minute cassette tape

Electric Motors AAVIM 5th Edition, 77 slides, cassette tape, manual, teachers guide and student workbook. Covers:

designed to help develop the knowledge and skills needed to select electric motors, overload protection devices and drives

Electric Motor Application and Characteristics - 46 slides and 18 minute cassette tape.

Electric Motor Review - a disk for use with Apple, IBM, TRS, MAC, covers:

476 review questions in 8 files. Topics include generation; name plate data; starting, operating and testing, wiring and overload protection; switches and controls; service and maintenance.

Electric Motor Speed Determination and Torque Curve - 37 slides and 12 minute cassette tapes, covers:

selecting electric motors for specific jobs. Contains classroom exercises and answer sheet.

Electric Motors: Enclosures, Bearings and Mounting Methods - 39 slides and 1 cassette tape, covers:

selecting electric motors for specific jobs. Contains classroom exercises and answer sheet.

Electric Motors Nameplate Data - 39 slides and 12 minute cassette tape

Electric Motors - Service and Maintenance - 57 slides and 24 minute cassette tape.

Electric Motors Transparency Master - 88 transparencies covering topics with Hobar Publication Electric Motors

Electrical and Basic Controls - 55 slides and 24 minute cassette, covers:

time clocks, photo cells, humidistats, switch and push button stations.

Ohio Agricultural Education, Curriculum Materials Service, Room 254, 2120 Fyffe Road, Ohio State University, Columbus, Ohio 43210-1099

Electric Motors - Selection, Protection, Drives AAVIM 1987 - 77 slides, 1 cassette, manual, script, teachers guide and student workbook.

How Electric Motors Start and Run AAVIM 1980 3rd Edition - 94 slides, texts and 2 cassette tapes

NASCO, 902 Janesville Avenue, Fort Atkinson, WI 53538

Electric Motors - set of 4 filmstrips with 173 frames covers:

magnetism and DC motors; induction and AC motors; testing connecting, identifying lead and reversing; trouble shooting electric motors.

5. Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 South Maryland Drive, Urbana, Illinois 61801

Electric Motors - 6 filmstrips with 274 frames covers:

magnetism and the DC motor; induction and the AC motor; testing and identifying lead, connecting and reversing; trouble shooting; cleaning electrical motors; and practical maintenance of electric motors.

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1. Resources

Address

Phone

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Fencing

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 and 12

OBJECTIVES: The students will be able to:

1. Use proper tools and equipment to safely build a fence.
2. Lay out and clear fence lines.
3. Select the type of fence best adapted for the function it is to serve.
4. Select the type of fencing equipment best adapted for the kind of fence.
5. Construct fences.
6. Maintain and repair fence.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agricultural Mechanic 288:3(a), 289:3(b-f), 295:21(a-b),
296:21(c-j), 296:23(a-q)

CONTENT:

I. Laying out and clearing fence lines

A. tools and materials needed

1. hand tools
2. tractor and loader
3. bulldozer

B. planning the fence line

1. laying out fence lines

- a. on areas of heavy under growth
- b. on open rolling areas
- c. on open level areas
- d. on contours

2. clearing the fence line

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|--------------|---------|-------|
|--------------|---------|-------|

D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

- 1.
- 2.
- 3.

II. Types of fences

- A. permanent vs. portable
 - 1. advantages
 - 2. disadvantaged
- B. barbed wire
- C. board
- D. cable
- E. "livestock-guards" (fence gates)
- F. chain link
- G. electric (AC/DC/Battery/Solar)
- H. electronic
- I. "flexi-net"
- J. high tensile
- K. "live"
- L. wood rail
- M. woven wire

III. Posts

- A. kinds and Types
 - 1. plastic
 - 2. metal
 - 3. concrete
 - 4. wooden
 - a. pressure treated
 - b. non-pressure treated

IV. Building

- A. safety
- B. tools and materials needed
- C. spacing and aligning
- D. installing posts
- E. bracing

F. installing fence

1. stretching wire
2. hanging woven panels
3. sawing and attaching boards

G. grounding wire fences

V. Building Gates

A. safety

B. tools and materials needed

C. types of gates

1. metal gates
2. wood gates
3. temporary gates
4. wire gates

VI. maintaining and repairing fences and gates

VII. calculating fencing costs

TEACHER ACTIVITIES:

1. Demonstrate safe use of tools and equipment.
2. Use lecture and discussion periods to cover theory of unit content.
3. Provide student with handouts when appropriate.
4. Arrange field trips.
5. Prepare projects and problems to provide skill training.
6. Provided samples of materials.
7. Provided actual fence construction experience.
8. Provide lab sheets, equipment, references and exams to accomplish objectives.

STUDENT ACTIVITIES:

1. Maintain a notebook on lectures and discussions.
2. Complete lab sheets.
3. Participate in classroom discussions.
4. Perform practical activities on fencing.
5. Complete practical and written exams.

EVALUATION:

1. All practical projects will be evaluated.
2. Quizzes and written test on all content.
3. Notebooks and lab sheets will be evaluated.
4. Evaluate performance of students doing practical work.

RESOURCES:

1. Samples of materials.
2. Reference materials.
3. Field trip areas.
4. Tools and equipment needed.
5. Gallagher "Spring-Tight" Power Fence, Brookside Industries, Inc., Turnbridge, Vermont 05077

BIBLIOGRAPHY:

References:

AAVIM, 120 Driftmier Engineering Center, Athen, Georgia

Planning Fences, 1980 #404 = manual \$5.50/ each

Building Fences, 1974 #305 = manual \$5.50/ each

Cooperative Extension, Northeast Regional Agriculture Engineering Service (NRAES), Riley Robb Hall, Cornell University, Ithaca, New York 14853

High Tensile Wire Fences - A.W. Selders, J.B. MaAninch, R.J.

Winchcomb, Order: NRAES - 11 @ \$1.00/ each

How to Build Fences with USS Max-Ten 200 High Tensile Fence Wire - United States Steel, Pittsburg, PA. 15230

Agriculture Mechanics: Fundamentals and Applications - Elmer L. Cooper, Delmar Publishers: Marketing Services, 2 Computer Drive West, Box 15015, Albany, New York

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AGRICULTURAL MECHANICS CURRICULUM

UNIT: Field Machines (Operation and Adjustment)

LENGTH: Six weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 and 12

OBJECTIVES: The students will be able to:

1. Identify common safety hazards around machines.
2. Demonstrate safe working practices with field machines.
3. Identify the various types of field machines and identify their parts.
4. Select proper field machines for the particular job.
5. Correctly adjust or calibrate field machines.
6. Use owners manuals.
7. Determine the advantages and disadvantages of purchase, lease, or rental of equipment.
8. Prepare machines for storage.
9. Plan a replacement schedule of agricultural machinery.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Farm Tractor and Equipment Operator	314 and 318
Tractor Mechanic Helper	302
Production Agriculture Mechanic	288:1(a-k), 291:10(a-m), 11(a-j), 292:11(k-w), 292:13(a-g), 292:13(h-o), 293:13(h-o), 293:14(a-o), 294:16(a-t)

CONTENT:

I. Safety

- A. Identify common machine hazards
- B. Human limitations and capabilities
- C. Safe machine operation
- D. Chemical safety
- E. Emergency situations
- F. Proper use of personal safety items

II. Field Machines

A. tillage machinery

1. primary tillage - plows, subsoiler, heavy disk plow
2. secondary tillage - disk harrow, cultivator, weeder, rotary hoe
3. hitching
4. adjusting tillage machinery
5. cleaning and storage

B. planting and seeding equipment

1. row crop planters
2. solid bed planting
3. seed monitors
4. seeding rates

C. weed, insect and soil fertility control equipment

1. liquid application equipment
2. sprayer components
 - a. types of pumps
 - b. nozzles and strainers
 - c. controls
3. dry chemical application
4. calibration of equipment
5. maintenance and storage of chemical application equipment

D. forage harvesting equipment

1. types of forage
2. cutting and conditioning equipment
3. windrowing and tedding equipment
4. hay balers and stackers
5. blowers
6. forage harvesters
7. storage systems
8. hitching
9. adjustment
10. cleaning, maintenance, and storage

E. grain harvesting equipment

1. types of combines
2. harvest losses

F. other machines (operation, adjustment, cleaning and storage)

1. nursery - tree digger, bare root cutter
2. orchard - pruner, sprayer, forklift
3. turf - roller, mower, cutter
4. vegetable - setter, landscaper, bed pruner mechanical harvester, plastic mulch applicator, mulch shredder.
5. backhoe

III. determining machinery costs

A. fixed costs - depreciation

B. operating costs

C. ownership alternatives

1. ownership
2. leasing
3. custom hire

TEACHER ACTIVITIES:

1. Present safety rules and procedures.
2. Demonstrate potential hazard situations around machines.
3. Demonstrate reaction times.
4. Provide field trips to local farms/agribusinesses and dealers.
5. Provide land and/or crops to demonstrate machines.
6. Provide owners' manuals to students.
7. Demonstrate sprayer calibration methods.

STUDENT ACTIVITIES:

1. Keep a notebook of handout materials and class notes.
2. Bring in machines to use in class/lab activities.
3. Collect literature on field machines.
4. Identify a potential machine hazard and the prevention of same.
5. Operate and adjust various field machines.
6. Learn the use of the owner's manual.

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Address

Phone

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1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Hydraulics

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 and 12

OBJECTIVES: The students will be able to:

1. Demonstrate safe working practices.
2. Identify the parts of a hydraulic system.
3. Identify and use hydraulic systems.
4. Determine the uses of hydraulic systems.
5. Diagnose a hydraulic system.
6. Perform hydraulic maintenance.
7. Explain how a hydraulic system operates (with the aid of schematics and drawings).
8. Read hydraulic schematics and drawings.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Plant Maintenance Mechanic	357:1(a-h), 358:2(u, v, s), 358:3(a-f)
Production Agriculture Mechanic	292:13 (a, c, d), 293:14 (c, g, h, m), 293:15 (a-s), 294:15 (t, u)
Plant Maintenance Mechanic	357:2 (jj)
Set-up Mechanic of Farms and Industrial Equipment	298:1(a-j), 298:2(a, b, c), 300:7(a-f) 301:8(a-m)
Tractor Mechanic Helper	303:8(a-d), 303:9(a), 305:12(a-q)

CONTENT:

I. Hydraulic Safety

- A. proper eye and personal protection
- B. power off and pressure relieved before working on hydraulic unit
- C. use caution when working with hot hydraulic fluid
- D. hydraulic fluid injected into skin can be serious (contact doctor immediately)
- E. never work on hydraulic unit unless accumulator is discharged (if in system)
- F. check owner's manual for safety pertaining to unit

II. Hydraulic Principals

- A. liquid characteristics
- B. how a hydraulic system works
 - 1. pump
 - 2. cylinder
 - 3. reservoir
 - 4. check valves
 - 5. relief valves
 - 6. control valve
- C. open-center system
- D. closed-center system
- E. variations of open and closed system

III. Hydraulics Uses

- A. steering systems
- B. brake system
- C. load sensing
- D. leveling system

IV. Pumps

- A. displacement
- B. types
- C. efficiency
- D. malfunctions
- E. diagnosing failures

V. Valves

- A. types
- B. operation
- C. failure and remedies
- D. repair
- E. trouble shooting

VI. Cylinders

- A. types
- B. extra features
- C. seals
- D. testing, diagnosing and maintenance

VII. Hydraulic Motors

- A. function
- B. displacement and torque
- C. types
- D. application and torque
- E. selection
- F. malfunctions
- G. diagnosing and maintenance

VIII. Accumulators

- A. uses
- B. types
- C. servicing and pre-charging

IX. Filters

- A. the how and why of filters
- B. types
- C. filtration and contamination
- D. maintenance

X. Hydraulic support systems

- A. reservoirs
- B. oil coolers
- C. hoses
- D. pipes, tubes and couplers
- E. seals
- F. fluids

XI. General Maintenance

- A. importance of cleanliness
- B. safety measures
- C. cleaning and flushing
- D. filling
- E. leaks
- F. overheating

XII. Diagnosis and Testing

- A. basic steps
- B. testing the machine
- C. trouble-shooting

TEACHER ACTIVITIES:

1. Emphasize safety in all operations.
2. Use lecture and discussion periods to (a) provide students with theory of hydraulics, (b) acquaint students with hydraulic systems, (c) introduce and demonstrate all practical aspects of hydraulics.
3. Provide students with hand-outs on the functioning of hydraulic systems, maintenance, and repair.
4. Demonstrate the operation of hydraulic systems, maintenance, and repair.
5. Provide actual student experience with actual systems.
6. Prepare shop problems and projects to provide skill training.
7. Provide lab sheets, materials, equipment, references and exams to accomplish objectives.

STUDENT ACTIVITIES:

1. Maintain a notebook on lecture and discussion.
2. Complete lab sheets.
3. Participate in classroom discussion.
4. Perform practical activities on actual equipment.
5. Participate in a practical and written exam.

EVALUATION:

1. All practical projects will be evaluated.
2. Quizzes and written test on all material.
3. Trouble-shooting evaluation.
4. Lab sheets will be evaluated.

RESOURCES:

1. Vo-Ag agricultural mechanics shop.
2. Hydraulic parts and tools.
3. Tractor and equipment.
4. Reference material.

BIBLIOGRAPHY:

Resources:

American Association for Agricultural Engineering and Vocational Agriculture (AAAE & VA), Tractor Hydraulics, Coordinator's Office Agricultural Engineering Building, Athens, Georgia 30602

American Association for Vocational Instructional Material (AAVIM), Hydraulic Systems for Tractors and Other Mobile Equipment, Care & Operation Vol. 1, AAVIM, 120 Engineering Center, Athens, Georgia 30602

Deere & Company, Fundamentals of Service - Hydraulics 3rd, John Deere Road, Moline, IL 61265

Owners' Manual

MEDIA:

Slide set and tape. Hydraulics (FOC), Deere & Company, John Deere Road, Moline, IL 61265

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AGRICULTURAL MECHANICS CURRICULUM

UNIT: New Equipment Assembly

LENGTH: Six weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 and 12

OBJECTIVES: The students will be able to:

1. Read and interpret photographs, assembly manuals and diagrams.
2. Use proper tools for assembly.
3. Identify various types of fasteners.
4. Demonstrate assembly skills.
5. Use parts catalog for ordering parts.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Plant Electrician	349:1(a-h), 249:2(a-j), 350:2(o, v, jj)
Setup Mechanic of Farms and Industrial Equipment	298:1(a-j), 299:3(c, g), 299:3(c-g), 299:4(a, g, h, j, k), 301:8(a-m)
Production Agriculture Mechanic	288:1(a-k), 294:16(a, b, c, e, r, s)
Partsman in Farm Machinery Dealership	306-309

CONTENT:

1. Review safety procedures and equipment.
2. Review and use of manuals.
3. Use of fasteners and tools.
4. Identification of parts.
5. Procedures used in assembly of new equipment.

TEACHER ACTIVITIES:

1. Obtain equipment to assemble (Examples: lawnmowers, tractors, harrows, sprayers).
2. Review general procedures to be followed in shop situations.
3. Demonstrate safety procedures.
4. Observe student work.
5. Demonstrate proper use of manuals.
6. show students use of manuals.

STUDENT ACTIVITIES:

1. Observe all safety procedures.
2. Read all instructions prior to starting all mechanical equipment.
3. Observe teacher and/or other students for proper assembly techniques.
4. Assemble equipment.
5. Double-check assembly specifications according to manuals.
6. Final sales preparation (Calibrate/touch-up).
7. Maintain notebook.

EVALUATION:

1. The teacher will:
 - A. review classroom notes taken by student.
 - B. evaluate tests and quizzes.
 - C. up-date/trouble-shoot evaluations of each student's assembly procedure and quality of assembly.

RESOURCES:

1. Shop tools and equipment available.
2. Develop list of local equipment dealers in area.
3. Develop list of major companies of equipment used in class.
4. Collect assembly plans and manuals from various sources.
5. Use microfiche

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AGRICULTURAL MECHANICS CURRICULUM

UNIT: Power Trains and Transmissions

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 or 12

OBJECTIVES: The students will be able to:

1. Demonstrate safe procedures when working with power trains and transmissions.
2. Define fundamental principles of mechanical systems.
3. Describe how power trains work.
4. Identify types and use of gears.
5. Identify gear wear.
6. Identify types of clutches and components.
7. Explain clutch operation.
8. Describe types of transmissions.
9. Describe differential/differential lock.
10. Identify types of P10s.
11. Trouble shoot power trains.
12. Adjust power trains.
13. Perform procedures of general maintenance.
14. Disassemble and repair power trains.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288:1(a-k), 293:15(a-s), 294:15(t, u), 294:17(a-i)
Tractor Mechanic Helper	305:12(a-q)

CONTENT:

I. Safety

- A. personal safety items
- B. safe use of jacks, jack stands and lifts
- C. hot fluids etc.

II. Gears

- A. types
- B. tooth wear and failure
- C. installation
- D. adjustments
 - 1. backlash
 - 2. end play

III. Clutch

- A. identification
- B. parts
- C. operation
- D. trouble shooting
- E. adjustment

IV. Bearings

- A. identification
- B. parts
- C. operation
- D. trouble shooting
- E. adjustment

V. Transmissions

A. mechanical

- 1. identify parts
- 2. operation
- 3. adjustments

B. hydraulic assist

- 1. parts identification
- 2. operation
- 3. adjustments

C. automatic

- 1. parts identification
- 2. operation
- 3. adjustments

VI. Power Take-Off

- A. safety
- B. types
- C. adjustments
- D. repair/replace

VII. Differentials

- A. types
- B. parts
- C. operation

VIII. Trouble Shooting

XI. General maintenance

TEACHER ACTIVITIES:

1. Emphasize safety in all operations.
2. Use of lecture to present main points.
3. Use audio-visual aides to explain principles.
4. Demonstrate adjustments and maintenance procedures.
5. Provide materials for student use.
6. Demonstrate use of special tools.

STUDENT ACTIVITIES:

1. Follow all safety practices.
2. Record through use of notebook, points as explained by teacher.
3. Complete worksheets and assignments.
4. Use Technical Service Manuals.
5. Inspect parts for wear.
6. Make adjustments.
7. Repair as necessary.

EVALUATION:

1. Observation of students.
2. Completion of worksheets.
3. Safety practices.

4. Quizzes and examinations
5. Students' ability to make adjustments.
6. Students' ability to maintain systems.
7. Students' attitudes toward proper completion of assignments.
8. Students' ability to diagnose and make repair.

RESOURCES:

1. Vocational Agriculture Mechanics Shop
2. Power train parts and tools
3. Reference materials
4. Parts and repair manuals

BIBLIOGRAPHY:

References:

Deere & Company, FOS: Power Trains, Moline, IL
Technical Service Manuals, all companies
Tractor Transmissions, AAVIM, Athens, GA
Ball & Roller Bearings, AAVIM, Athens GA
General Agriculture Mechanics Vol II, Vocational Instructional
Services, Pre-employment Training, Texas
Tractor Maintenance Principles & Procedures, AAVIM, Athens, GA

MEDIA:

Transparencies FOS: Deere & Company
Slides, Clutches, International Harvester

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- 2.
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AGRICULTURAL MECHANICS CURRICULUM

UNIT: Private Water Supplies and Septic Systems

LENGTH: Three weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 or 12

OBJECTIVES: The students will be able to:

1. Demonstrate safe practices when handling chemicals.
2. Determine the water needs for family and situation.
3. Identify various sources of water.
4. Select the type of well best suited to meet requirements.
5. Locate the most desirable site for a well.
6. Determine the establishment of catchments, cisterns and ponds, and the development of springs.
7. Identify the types, installation and operation of the various pumps and pressure tanks.
8. Identify the factors that govern water quality.
9. Check all sanitation precautions.
10. Sample and test or have home water supply tested.
11. Identify types of septic systems.
12. Determine size of septic systems.
13. Determine condition of septic systems.
14. Outline a program of septic system maintenance.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic 288:3(a), 289:3(b-f), 295:20(a-u),
22(a-j)

CONTENT:

I. Safety

- A. proper use of safety glasses
- B. safe use of chemicals
- C. body and hand protection

II. Water Quantity

- A. calculate needs for family use
- B. calculate needs for livestock
- C. calculate needs for crop irrigation

III. Water Sources

- A. hydrologic cycle
- B. ground water - water table
- C. aquifer

IV. Types of Water Collectors

- A. wells
- B. catchments and cisterns
- C. ponds
- D. springs
- E. state and local rules and regulations

V. Water Quality

- A. factors affecting water quality
- B. chemical analysis
 - 1. testing water
 - 2. controlling water chemicals
 - 3. controlling off-flavors
 - 4. controlling turbidity
- C. bacteriological analysis
 - 1. sanitary protection for underground water
 - 2. sanitary protection for surface water
 - 3. testing for contamination
 - 4. disinfecting contaminated water

VI. Pumps

- A. types of pumps
- B. characteristics
- C. location
- D. cost
- E. accessories
- F. protection

VII. Storage Tanks

- A. types of storage tanks
- B. characteristics
- C. location
- D. cost
- E. accessories
- F. protection

VIII. Septic Systems

- A. types
- B. size
- C. tanks and leaching fields
- D. raised systems
- E. function
- F. maintenance
- G. state and local rules and regulations

TEACHER ACTIVITIES:

1. Present safety rules and procedures.
2. Demonstrate calculations for determining livestock and crop needs for water.
3. Explain hydrologic cycle.
4. Describe and show examples of types of wells.
5. Explain how and where catchments, cisterns and ponds are used.
6. Describe various types of pumps.
7. Demonstrate taking water samples.
8. Demonstrate water testing.

STUDENT ACTIVITIES:

1. Keep a notebook of handout materials and class notes.
2. Solve problems to determine water quality.
3. Construct a hydrologic cycle chart.
4. Determine water sources available in community.
5. Take a water sample to be tested.
6. Test water for bacteriological and chemical contamination from a number of different sources.
7. Obtain state law requirements to determine safe water levels.
8. Visit a well digger to discuss well digging.
9. Visit a water quality laboratory to discuss analysis procedures.
10. Construct a model septic system.
11. Visit town hall to discuss local laws regarding septic system requirements.
12. A field trip to a water treatment plant.

EVALUATION:

1. Quizzes and tests on material present.
2. Diagram of water leaving strata and type of well used.
3. Classroom exercises.
4. Have students record observations and information obtained on field trips.

RESOURCES:

1. Various types of pumps secured from plumbers.
2. Well digger.
3. Water quality test lab.
4. Hach Company, P. O. Box 389, Loveland, Colorado 80539 - Test kits to measure water quality
5. LaMotte Chemical Products Company, P.O. Box 329, Chestertown, Maryland 21620 - Test kits to measure water quality
6. Municipal offices - building inspector, sanitarian

BIBLIOGRAPHY:

References:

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112

Private Water Systems - 60 pages - covers water quantity, water quality; and water sources.

Instructional Materials Service, Department of Education, Cornell University, 24 Roberts Hall, Ithaca, NY 14853-5901

A Study of Water Quality - 46 pages - a study of biological and chemical processes that take place in natural water supplies.

Investigating Water Problems - 72 pages - background information about water quality factors and basic field and laboratory testing.

Instructional Materials Service, Texas A&M University, F. E. Box 2588, College Station, Texas 77843

Farm Water Supply and Sanitation

Ohio Agricultural Education, Curriculum Materials Service, Room 254, 2120 Fyffe Road, Ohio State University, Columbus, Ohio 43210-1099

Planning for an Individual Water System - 1982 - determining water needs; protecting sources from pollution; conditioning water; planning a system and disinfecting water.

MEDIA:

Elmbrook Communications, 21100 West Capital Drive, Pewaukee, WI 53072

Ground Water and Agriculture Chemicals: Understanding the Issues

a) 17 minute video or 16 mm movie loaned free of charge

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AGRICULTURAL MECHANICS CURRICULUM

UNIT: Small Gasoline Engines Repair and Overhaul

LENGTH: Six weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 or 12

OBJECTIVES: The students will be able to:

1. Demonstrate safe procedures when repairing and overhauling small gas engines and components.
2. Define basic terms of engine theory.
3. Identify types of small gasoline engines.
4. Identify the parts of small gasoline engines.
5. Identify fuel systems and perform general maintenance.
6. Identify air cleaners and perform general maintenance.
7. Maintain, adjust, disassemble, and repair carburetor.
8. Define parts of the magnetic ignition system and explain their function.
9. Define basic electrical functions and explain their importance to the small gasoline engine.
10. Disassemble, repair and reassemble ignition systems.
11. Read and use an owner's manual and service manual.
12. Troubleshoot small gasoline engines.
13. Sharpen and balance a lawn mover blade.
14. Maintain and adjust interlock safety systems.
15. Disassemble and reassemble engines.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Set-up Mechanic of Farm and
Industrial Equipment
Small Engine Mechanic
Production Agriculture Mechanic

Plant Maintenance Mechanic
Tractor Mechanic's Helper

298:1(a-j), 300:7(a-f), 301:7(g-m),
301:8(a-m)
310-313
288:1(a-m), 2(a-i), 291:10 (a-m)
11(a-j), 292:11(k-w), 12(a-x),
292:13(a-q)
357:1(a-h), 2(a-i), 358:2(j-t), 3(a-h)
302:1(a-h), 2:(a-q), 3(a-b), 303:3(d,
g, h, i, n, e, r), 303:4(a-f), 5(a-g),
6(a-g), 304:11(a-v), 305:12(a-q)

CONTENT:

I. Safety

- A. proper use of safety glasses
- B. safe use of cleaning solvents
- C. safe handling of flammable materials
- D. properly secure engine onstand
- E. disconnect the spark plug wire
- F. proper use of tools and testing equipment
- G. clutch disengaged - transmission in neutral
- H. proper ventilation of exhaust fumes.

II. Gasoline engine fundamentals

- A. classification of engines
 - 1. 2-cycle, 4-cycle
 - 2. water cooled, air-cooled
 - 3. diesel, gasoline
- B. definition of a gasoline engine
- C. operating principles
- D. fuel
- E. valves
- F. description of horsepower
- G. comparison of engines
 - 1. horizontal shaft
 - 2. vertical shaft
- H. classification of engines
- I. gasoline engine parts
- J. evaluation of internal parts

III. Carburetion

- A. general information
 - 1. purpose
 - 2. atmospheric pressure
 - 3. venture
- B. gravity feed (flow-jet)
- C. vacu-jet systems
- D. pulsa-jet systems

- E. evaluation of carburetion systems
- F. air cleaners

IV. Ignition

- A. basic electricity DC systems
- B. magnetic/electronic systems
- C. testing spark
- D. spark plugs
- E. ignition assembly and adjustments
- F. ignition evaluation
- G. air gap

V. Manuals and Identification

- A. owners' manual
 - 1. warranty
 - 2. importance
 - 3. contents
- B. engine nomenclature
- C. service manuals
- D. service manuals
 - 1. parts identification
 - 2. reference numbers
 - 3. part numbers
 - 4. cost determination

VI. Troubleshooting

- A. general engine information
 - 1. ignition
 - 2. fuel
 - 3. compression
- B. major problems

VII. General information

- A. blade conditions
- B. winter storage
- C. normal maintenance procedures and recommendations

VIII. Major disassembly

- A. general procedure
- B. carburetor
- C. ignition
- D. crankshaft
- E. governor parts
- F. connecting rod and piston
- G. cylinder and valves
- H. cleaning

IX. Reassembly

- A. crankshaft
- B. rings, piston and connecting rod
- C. cam gear
- D. governor and miscellaneous parts (oil spasher)
- E. tappets and valves
- F. ignition systems
- G. cylinder head and shield
- H. carburetor and linkage
- I. adjustments

TEACHER ACTIVITIES:

1. Present safety rules and procedures.
2. Present fundamentals of engine theory, carburetion, ignition, manuals, safety and engine disassembly and reassembly.
3. Demonstrate all disassembly, repair and reassembly.
4. Provide students with engines to perform aspects of theory presented on the engines.
5. Furnish the necessary labs sheets, materials, equipment, references and exams to accomplish objectives.
6. Observe and supervise student activities to insure proper skill development.

STUDENT ACTIVITIES:

1. Keep a notebook of handout materials and class notes.
2. Complete class handouts.
3. Participate in class discussion.
4. Perform mechanical activities in order to accomplish objectives.
5. Read and interpret engine manuals.
6. Students may bring in engines which are in need of repair or maintenance.

EVALUATION:

1. Notebook organization and materials collected.
2. Monitor student skill development.
3. Quizzes and written test on all material.

4. Lab sheets will be evaluated.
5. Practical test on shop skills.

RESOURCES:

1. Shop
2. Engines
3. Test equipment
4. Common small gasoline engine hand tools
5. Parts cleaner
6. Petroleum solvents

BIBLIOGRAPHY:

References:

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112

Briggs and stratton 4-cycle Air Cooled Engine Repair Instructions.

Lawn, Garden and Outdoor Power Equipment Shop Source - small and large air colled engines, walking and riding lawn mowers, compact tractors and tillers.

Overhauling Piston, Rings, Cylinder and Rod Worksheet

Overhauling Valves Worksheets

Quick Reference Parts Manual - Briggs and Stratton, Chrysler, Clinton, Kohler, O&R, Roper and Tecumseh - covers carburetor, ignition and engine drive parts.

Small Gasoline Engine Worksheets - covers all phases of small engine servicing and repair - 21 pages.

Small Tractor Shop Service - includes tractors through 1 6HP and compact tractors 16HP+

Instructional Materials Service, 24 Robert Hall - Cornell University, Ithaca, NY 14853-5901

M109 - Small Engines-Repair and overhaul 4-Cycle Engines

M125 - Small Engine Service Manual

M127 - Walking Lawn Mower Service Manual

Ohio Agriculture Education, Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, Ohio 43210-1099

Compact Tractor Service Manual, Intertec 1986 - 70 models of major tractor brands - complete servicing, maintenance and troubleshooting.

Engines, 1982 FOS Compact Equipment Series cover theory of 2- and 4-cycle engines. Describes fundamentals of service for all engine systems.

Riding Lawn Mower - Service Manual, Intertec 1984 - Complete service manual including maintenance, interlock safety systems, cutting blades, drive belts, drive chain and repair.

Small Engine-Operation, Maintenance, Repair, AAVIM 1988 Covers repair of small engines.

Small Engines Service Manual, Intertec 1986 - 15th Edition - A complete manual with diagrams and instructions for maintenance of major brands for small gasoline engines.

Walk Behind Lawn Mower - Service Manual, Intertec 1987 - 2nd Edition - A complete manual covering maintenance, cutting blades, troubleshooting and repair instructions.

Tecumseh Products, 900 North Street, Grafton, Wisconsin 53024

Motion Drive Systems Repair Manual - Part no. 691630

Electrical troubleshooting Booklet - Part no. 693505

Ignition Troubleshooting Booklet - Part no. 694903

Carburetor Troubleshooting - Part no. 694824

MEDIA:

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112

Briggs & Stratton Engine Model Number & Overhaul Specifications - for Apple computer, covers:

model numbers, determine basic engine torque, tune-up specifications and reject sizes.

Overhauling the Piston, Rings, Cylinder and Rod - 68 slides and 25 minute cassette, covers:

discussion of chrome rings or standard rings - oversizing the cylinder - using oversize piston - use of tools and measuring instruments.

Overhauling the Valve System - 56 slides and cassette, covers:

step by step procedure for overhauling valve with emphasis on safety, selection of tools and use of service manual.

Small Engine Disassembly and Assembly Laboratory - 80 slides, cassette and script, covers:

complete disassembly and assembly of Briggs and Stratton small engines with emphasis on the basic compression and drive components.

Small Engine Know-How - 12 filmstrips and cassettes, covers:

small engine systems; fuel systems and ignition
troubleshooting; routine maintenance; and major overhaul.

Small Engine Part Numbers - for Apple Computer, covers:

Tecumseh 2- and 4-cycle, Briggs & Stratton, Clinton Kohler,
Powerbee engine parts.

Small Gas Engine Parts Identification - for Apple Computer, covers:

software programs illustrated to teach small parts
identification

Small Engine Repair Shop - for IBM and Apple Computer, covers:

diagnose five engines and determine cause of their problem.

Tecumseh Model No. and Overhaul Specifications - for Apple
Computer, covers:

model number, determines basic engine tune-up specifications
and reject sizes.

Tecumseh Part Numbers, Craftsman 3-10 H.P. - for Apple computer,
covers:

designed to supply the user with information on manufacturers
part numbers, tune-up specifications, torque specifications and
part notes from six manufacturers of air cooled engines.

Washing the Lawnmower and Servicing the Rotary Blade - 41 slides
and cassette

Ohio Agriculture Education, Curriculum Materials Service, Room 254,
2120 Fyffe Road, Ohio State University, Columbus, Ohio 43210-1099

Care and Operation of Small Gasoline Engines - for Apple Computer,
covers:

Students use the software as a reinforcement of concepts
learned from the text through a review of questions. Has the
ability to produce quizzes and tests.

Outdoor Power Equipment Repair - 433 Page teachers guide with 43
transparency masters, student manual also available.Small Gas Engine Parts Identification Test - for Apple Computer,
covers:

Illustrated to teach small engine parts identification. Grades
of each student taking the test are automatically recorded.

INDIVIDUAL TEACHER UNIT REVIEW

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2. Bibliography -

C. ADDITIONAL AND UPDATED RESOURCES INCLUDING ADDRESSES AND PHONE NUMBERS:

1. Resources	Address	Phone
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D. WHEN TAUGHT AGAIN I WOULD MAKE THESE CHANGES:

1.

2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Tractor Engine Overhaul

LENGTH: Six weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 or 12

OBJECTIVES: The students will be able to:

1. Demonstrate safe practices when performing engine overhaul.
2. Identify tools and parts.
3. State the use of appropriate service tools.
4. Use diagnostic procedures to initially trouble shoot engines.
5. Remove and mount an engine on a rebuilt stand.
6. Remove and inspect engine head.
7. Determine condition of the crankshaft.
8. Inspect and determine condition of engine block.
9. Demonstrate skills for servicing valve components.
10. Determine condition of the camshaft.
11. Service the connecting rods.
12. Service the wrist pins.
13. Remove pistons and determine condition.
14. Measure cylinders and determine condition.
15. Service the clutch pack components.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288:1(a-k), 288:2(a-j), 292:12(a-x)
Tractor Mechanics Helper	302:1(a-g)

CONTENT:

I. Safety

- A. proper use of safety glasses
- B. hand and body protection
- C. safe use of cleaning solvents

D. safe handling of flammable material

II. Tools

- A. identification
- B. safe use of tools
- C. clean tools

III. Diagnostic

- A. operator information
- B. exhaust - color and density
- C. engine noises
- D. oil pressure
- E. water temperature
- F. blowby
- G. external leaks
- H. compression tests
- I. dynamometer test

IV. Remove and mount engine on stand

- A. clean engine
- B. remove accessories
- C. drain oil and coolant
- D. split tractor
- E. mount engine on stand
- F. remove pan and oil pump

V. Engine head

- A. remove head
- B. clean head
- C. inspect for cracking and check for warping
- D. inspect head gaskets for defects
- E. inspect for clogged oil and water passages

VI. Crankshaft

- A. measure crankshaft endplay
- B. measure backlash between the cam gear and the crankshaft gear
- C. check the timing marks on the cam gear and crankshaft gear and check for wear, burrs, broken teeth and cracks
- D. remove and clean the crankshaft
- E. check the alignment of the crankshaft
- F. measure the journal for out-of-round or the taper of the journal
- G. inspect the crankshaft journals for excessive wear, pitting, scratching or other damage
- H. check for ridges on the crankshaft journal and determine when to have the crankshaft ground

VII. Block

- A. inspect for a cracked engine block or hairline fractures in the cylinder wall
- B. inspect the cylinder wall surface for a glazed surface or for a cylinder ridge

- C. measure the cylinders for taper or out-of-round
- D. inspect the block for clogged oil passages and water passages

VIII. Valves

- A. inspect the valve face and seat contact
- B. measure the valve tappet clearance or cam follower clearance
- C. remove valves from the head or engine block
- D. inspect the valves for defects such as burning, dishing, pitting or sticking in guides
- E. measure the valve seat for out-of-round
- F. measure valve margin
- G. inspect the valve spring
- H. measure the valve guide clearance

IX. Timing assembly

- A. locating the timing marks
- B. check the valve timing
- C. check the timing assembly for worn gears
- D. remove the timing assembly or gears

X. Camshaft

- A. measure camshaft endplay
- B. remove the push rods and cam followers
- C. inspect push rods and cam followers for wear or damage
- D. remove the camshaft journals and cam lobes for wear
- E. measure the camshaft journals and cam lobes for wear
- F. inspect and measure camshaft bushings

XI. Connecting rods

- A. mark and remove rod and bearing cap
- B. clean rod and cap
- C. inspect for distortion and fatigue of rods
- D. inspect the rod bearing inserts for cracks, scoring, scuffing or rough edges
- E. measure bearing clearance

XII. Wrist pin

- A. remove the piston pin and mark the pin
- B. inspect the pin for looseness, etching, scoring or excessive damage
- C. check the pin for out-of-roundness
- D. check the piston pin bore for taper or bell-mouthin
- E. inspecting the snap rings

XIII. Pistons

- A. mark and remove pistons
- B. remove ridge
- C. identify rod caps
- D. remove rings and identify compression, scraper and oil rings
- E. clean pistons and rings
- F. inspect for scratches, scoring, scuffing and broken ring lands

- G. measure ring groove clearance
- H. measure ring-end gap
- I. measure piston diameter for wear and determining piston skirt clearance.

XIV. Cylinders

- A. measure bore
- B. visually inspect for defects
- C. replace liners of bore and hone

XV. Clutch pack

- A. remove the clutch assembly
- B. check the flywheel friction driving surface for flatness and/or roughness
- C. inspect the pilot bearing
- D. inspect the clutch plate for warpage
- E. inspect the clutch disks for cracks or loose rivets
- F. check the clutch plate for warpage
- G. inspect the springs for corrosion, pitting or distortion
- H. check the spline for wear as an indicator or misalignment
- I. reassemble the clutch pack
- J. install the clutch pack and adjust the release levers

XVI. Ring gear

- A. inspect the flywheel
- B. remove the flywheel
- C. remove the ring gear from the flywheel
- D. install the ring gear on the flywheel
- E. install the flywheel

XVII. Reassemble

- A. install cam bearings, followers, lifters and camshaft
- B. install crankshaft with bearings and torque with plast-gauge
- C. check timing marks before covering
- D. install rings on pistons after assembly to rods
- E. install piston and torque with plasti-gauge
- F. install rebuilt or serviced oil pump, gasket and pan
- G. install clutch pack with new throwout bearing and pilot bearing

XVIII. Engine run-in

- A. check for leaks initially and after engine is up to operating temperature
- B. check oil pressure, water temperature, charging circuit and radiator
- C. recheck all connections

TEACHER ACTIVITIES:

1. Present safety rules and procedures.
2. Demonstrate to students the use of technical and part manuals.
3. Identify tools and explain proper usage.
4. Demonstrate all major steps in disassembly and reassembly.
5. Observe and supervise student activities to insure proper skill development.

STUDENT ACTIVITIES:

1. Keep a notebook of handout materials and class notes.
2. Inspect and clean an engine.
3. Diagnose and determine service requirements.
4. Select and use appropriate service tools to rebuild engines to the fullest extent using recommended procedures with all other work done by a competent machine shop.
5. Gain experience in ordering correct parts, using manuals and service request form.
6. Keep a daily worksheet noting progress on servicing project.

EVALUATION:

1. Work to be checked daily on each engine.
2. Quizzes and exams.
3. Rate success of engine starting and operating correctly with a minimum of reworking.
6. Petroleum solvents

BIBLIOGRAPHY:

References:

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112

I&T Shop Service Master Set - 4000 pages of details on service, maintenance and repair procedures for all wheel-type tractors manufactured during the last 15 years.

Instructional Materials Service, College of Agriculture, University of Illinois, 1401 South Maryland Drive, Urbana, IL 61801

Engine Compression and Cylinder Leakage Testing - 16 pages

MEDIA

Instructional Materials Service, College of Agriculture, University of Illinois, 1401 South Maryland Drive, Urbana, IL 61801

Diesel Engine Pump and Injection Series - 4 slide program - 87 frames, covers:

removing diesel injection nozzles; servicing diesel injection nozzles, testing diesel injection nozzles; and types of diesel injection nozzles.

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2.

3.

AGRICULTURAL MECHANICS CURRICULUM

UNIT: Tractor Maintenance

LENGTH: Six weeks. Select areas of content by student needs and time available.

WHEN TAUGHT: Grade 11 or 12

OBJECTIVES: The students will be able to:

1. Demonstrate safe practices when performing tractor maintenance.
2. Select and maintain batteries.
3. Identify components which require greasing.
4. Maintain dry-type and oil bath air cleaners
5. Select oil, maintain oil levels and change oil when necessary.
6. Maintain the cooling system.
7. Select and maintain an electrical system.
8. Refuel tractors to avoid a fire hazard.
9. Maintain tractor tires.
10. Identify and maintain brakes..
11. Examine PTO for safe condition.
12. Explain the owner's manual.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Tractor Mechanics Helper	302-305
Production Agriculture Mechanic	291:10(a-m), 291:11(a-j), 292:11(k-w), 292:13(a-g), 293:13(h-o), 293:14(a-o)
Farm Tractor and Equipment Operation	314:1(a-d), 315:1(e-k), 318:8(a)

CONTENT:

I. Safety

- A. proper use of safety glasses
- B. care in handling hot lubricating oils
- C. care when working with radiator
- D. precautions when refueling
- E. check owner's manual for safety precautions

II. Systems - functions, parts identification and repair

- A. electrical - ignition, charging and accessories
- B. cooling
- C. fuel
- D. power train
- E. lubrication
- F. hydraulic
- G. chassis

III. Electrical

A. batteries

- 1. determining power requirements
- 2. determining operating conditions
- 3. selecting batteries
- 4. maintaining liquid level
- 5. maintaining terminals and clamps
- 6. using a hydrometer to check electrical condition
- 7. recharging batteries

B. Ignition

- 1. check plugs for fouled or eroded condition
- 2. points and condenser
- 3. condenser
- 4. distributor
- 5. coil
- 6. ignition wires
- 7. troubleshooting

C. Charging

- 1. generator
- 2. alternator
- 3. voltage regulator

IV. Cooling system

- A. selecting coolant
- B. maintaining proper coolant level
- C. preventing corrosion and deposits
- D. preventing freezing and overheating
- E. cleaning the cooling system
- F. changing hoses
- G. pressure cap test
- H. fan belt and fan
- I. thermostat

V. Refueling

- A. selecting fuel
- B. keeping out dirt and moisture
- C. types of filters
- D. avoiding fire hazards
- E. removing water from diesel fuel systems

VI. Hydraulic, transmission crankcase and brakes

- A. selecting oil
- B. maintaining proper oil level
- C. changing oil
- D. changing oil filters
- E. clean crankcase breather
- F. bleeding air from system
- G. check for leaks

VII. Greasing

- A. selecting grease
- B. identify parts requiring grease
- C. locating grease fittings
- D. using a grease gun
- E. developing a grease schedule

VIII. Air Cleaners

- A. maintaining dry type cleaners
- B. maintaining oil bath type cleaners

IX. Steering

- A. lubricants
- B. fluid levels
- C. bleed air from systems
- D. adjust power steering pump tension
- E. check system for leaks

X. PTO

- A. safety shields
- B. lubricating universal joints
- C. inspection of bearings, seals, universal joints

XI. Tires

- A. construction
- B. selection
- C. installation
- D. inflation
- E. adding weight
- F. repair
- G. checking tire pressure

X. Owner's manual

- A. reading and interpreting
- B. locating specifications for making adjustments
- C. storage and caring of manual

TEACHER ACTIVITIES:

1. Present safety rules and procedures.
2. Obtain tractors for practical work in shop.
3. Explain the function and identification of systems and parts.
4. Explain maintenance required on tractors.
5. Demonstrate maintenance procedures to be completed.
6. Observe and supervise student activities to insure proper skill development.

STUDENT ACTIVITIES:

1. Keep a notebook of handout materials and class notes.
2. Observe gasoline and diesel tractors to compare difference.
3. Determine the condition of a battery with a hydrometer.
4. Compare viscosity and grades of oil for use in various systems.
5. Recharge a battery.
6. Change oil in oil reservoirs.
7. Change a tire and check inflation rate.
8. Flush and refill radiator with radiator coolant.
9. Refuel tractor for operation.
10. Grease all fittings for operation.
11. Clean and gap spark plugs.
12. Develop a plan for safe storage and disposal of fuels and lubricants at home.
13. Lubricate power take-off drive shaft.

EVALUATION:

1. Quizzes and tests on classroom material.
2. Monitor student skill development on maintenance procedures.
3. Student notebook.

RESOURCES:

1. Shop
2. Field trip to tractor dealer
3. Tractors
4. Hydrometer
5. Sulfuric acid solution
6. Coolant
7. Spark plug feeler gauge
8. Batteries
9. Grease
10. Grease gun
11. Operator's manual
12. Samples of fuels and lubricants
13. Used and worn parts for observation

BIBLIOGRAPHY:

References:

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112

Fundamentals of Service - John Deere - 4 instructor and student guides covering hydraulics, electrical systems, engines and power trains.

I&T Shop Service Master Set - 4000 pages of details on service, maintenance and repair procedures for all wheel-type tractors manufactured during the last 15 years.

Machinery Maintenance - John Deere - instructor and student guide.

Preventive Maintenance - John Deere - covers all types of engine powered equipment, steps how to complete maintenance, and how to develop a schedule of daily, weekly and monthly maintenance jobs.

Instructional Materials Service, College of Agriculture, University of Illinois, 1401 South Maryland Drive, Urbana, IL 61801

Farm Tractor Tune-up 12 pages

Storing, Handling and Using Fuels Safety - 16 pages

Instructional Materials Service, Department of Education, Cornell University, 24 Roberts Hall, Ithaca, NY 14853-5901

Engine Cooling System - 24 pages - describes types, processes and parts.

The Storage Battery - 32 pages - sections on construction, installation, service, charging and testing.

Instructional Materials Service, Texas A&M University, F.E. Box 2588, College Station, Texas 77843.

Importance of Engine Maintenance and Methods of Cleaning.

Tractor Maintenance, Operation and Daily Care.

Tractor Maintenance, Servicing, Air Cleaners, Lubrication.

Interstate Publishers, Inc., P.O. Box 50, Danville, IL 61843-0050

Diesel Mechanics: Electrical Systems - 1988 - eight units covering understanding electrical circuits, storage batteries, starting systems, ignition circuits, alternating charging circuits and energy shutdown.

Engines - FOS - 1986 - 6th Edition - covers basic theory on 4-, 6-, and 8-cylinder engines; how they work basic components, engine systems, fuel, intake and exhaust, lubrication, cooling and governing. Explains engine test equipment and service tools, diagnosis and testing and engine tune-up.

Fuels and Lubricants - selecting fuels or lubricants for gasoline, LP gas and diesel engines, proper storage of fuels and lubricants, conserving fuels.

Hydraulics - 1986 - 14 units covering fundamentals, systems and components, advanced systems and hydrostatic drives.

Hydraulics for Tractors and Other Mobile Equipment - Volume 2 - covers principles and procedures of reservoirs and coolers, lines and fittings, cylinders, valves, accumulators, motors, pumps and troubleshooting.

Power Trains - 1982 - Nine units of instruction covering introductory material, clutch and flywheel, torque convertors and fluid drives, mechanical transmissions, automatic and power shift, drive lines, differentials and final drives.

Specification for Tune-up and Service of Farm Tractors - 1982 - charts for tune-up and lubrication for each models of tractor since 1948.

MEDIA

Hobar Publications, 1234 Tiller Lane, St. Paul, MN 55112

Fundamentals of Service - 670 transparencies, covers:

maintenance of engine, steering assembly, brakes, clutches, hydraulic system and proper tractor storage.

That Engine May Live - John Deere - 60 minute video cassette, covers:

clean air, efficient cooling, lubrication and clean fuel

Instructional Materials Service, College of Agriculture, University of Illinois, 1401 South Maryland Drive, Urbana, IL 61801

Operator Responsibility for Diesel Engine Maintenance - filmstrip - 62 frames covers:

diesel fuel selection and storage and use of starting aids; lubrication, air filter and fuel system servicing procedures.

Instructional Materials Service, Department of Education, Cornell University, 24 Roberts Hall, Ithaca, NY 14853-5901

Tractor Tune-up and Maintenance - 36 transparencies with script, covers:

maintenance of engine, steering assembly, brakes, clutches, hydraulic system and proper tractor storage.

Ohio Agriculture Education, Curriculum Materials Service, Room 254, 2120 Fyffe Road, Ohio State University, Columbus, OH 43210-1099

Belts and Chains - 1984 - 3rd Edition - 80 slides, covers:

theory, types, operation, maintenance, failure and troubleshooting.

Hydraulics and Related Review - for Apple computers, covers:

400 items related to types, operation and principles, service and maintenance.

Tires and Tracks - 1986 - 6th Edition - 80 slides, covers:

tires - construction, inflation, ballasting, failure, repair mounting and demounting; tracks - construction, inspection, lubrication, adjustment, diagnosis of wear and repair.

Tractors - for Apple computer, covers:

engines, power trains, hydraulics, electrical systems and maintenance.

Projected Learning Program, Inc., P.O. Box 3008, Paradise, CA
95967-3008

Agri-Quiz - Tractor Maintenance - for Apple, IBM computers, covers:

general review of mechanical concepts that pertain to tractor
maintenance.

Vocational Educational Productions, California Polytechnic State
University, San Luis Obispo, CA 93407

Kubota Diesel Engine Maintenance - 23 minute video, covers:

operation and maintenance of the air filtration system, fuel
system, lubrication system and cooling system.

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PRODUCTION AGRICULTURE MECHANIC

Job Description:

Beginning employees or beginning owners or operators in farming and ranching must make repairs to buildings, facilities, and equipment; and at times construct new equipment, facilities, or buildings according to the needs of their farm or ranch.

Competencies Identified and Validated

N = 107*

Competencies	Weighted Mean**
1. Identify and fit shop tools and equipment.	<u>2.3</u>
a. Identify tools and equipment.	3.0
b. Fit handles in hammers, axes, hatchets, and picks.	2.6
c. Sharpen twist drills.	2.5
d. Fit handles in hoes, rakes, and forks.	2.5
e. Sharpen shovels and hoes.	2.3
f. Sharpen cold chisels and plane blades.	2.3
g. Sharpen screwdrivers.	2.2
h. True grinding wheels.	2.1
i. Sharpen axes, hatchets and picks.	2.1
j. Sharpen auger bits.	2.0
k. Sharpen wood chisels and plane blades.	2.0
2. Maintain and service a home farm shop.	<u>2.5</u>
a. Maintain a clean and orderly shop area.	3.2
b. Place and use fire fighting equipment.	3.1
c. Maintain and service air compressor.	2.6
d. Order and inventory supplies and parts.	2.6
e. Install power driven equipment.	2.5
f. Understand and apply OSHA and/or COSH regulations.	2.4
g. Plan shop layout.	2.4
h. Select shop building.	2.3
i. Inventory tools and equipment.	2.3
j. Select shop site.	2.1
3. Use drawings and blueprints.	<u>2.4</u>
a. Read and interpret drawing.	3.1

* Responses from 107 Farmers and Ranchers in 20 states. Survey conducted by Agricultural Education Section, Department of Vocational Education, Colorado State University, Fort Collins, Colorado 80523.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

b.	Apply dimensions to drawings.	2.8
c.	Figure bills of materials.	2.7
d.	Read blueprints.	2.0
e.	Make free hand sketches.	1.9
f.	Make drawings to scale.	1.9
4.	Learn farm carpentry skills.	<u>2.5</u>
a.	Drive and remove nails.	3.0
b.	Operate power saws.	3.0
c.	Saw to dimension with hand and/or power saws.	3.0
d.	Bore holes.	2.8
e.	Set screws.	2.8
f.	Select appropriate fasteners (nails, hinges, etc.).	2.7
g.	Select kinds and grades of lumber for a job.	2.7
h.	Lay out and construct small buildings.	2.6
i.	Plane to dimension with hand and/or power tools.	2.5
j.	Use wood chisels.	2.4
k.	Lay out and cut common rafters.	2.4
l.	Glue wood.	2.3
m.	Operate jointer.	1.6
n.	Operate thickness planer.	1.5
5.	Properly use paint and painting equipment.	<u>2.6</u>
a.	Clean and store spray gun.	2.9
b.	Clean and store paint brushes and rollers.	2.9
c.	Prepare metal surfaces.	2.6
d.	Prepare wood surfaces.	2.6
e.	Apply paint with brush or roller.	2.6
f.	Select paints or preservatives.	2.6
g.	Apply paint with spray gun.	2.5
h.	Mask areas prior to painting.	2.5
i.	Compute area for applying paint or preservatives.	2.4
6.	Operate an arc welder.	<u>2.9</u>
a.	Practice safety in arc welding.	3.5
b.	Operate AC welder.	3.4
c.	Select electrodes.	3.4
d.	Determine amperage and polarity settings.	3.4
e.	Strike arc.	3.4
f.	Prepare metal for welding.	3.3
g.	Run flat beads.	3.2
h.	Make butt welds.	3.2
i.	Make lap welds.	3.2
j.	Make fillet welds.	3.1
k.	Run vertical beads.	3.1
l.	Construct equipment using arc welder.	3.1
m.	Run overhead beads.	3.0

n.	Control distortion.	2.9
o.	Hard surfaces with arc.	2.8
p.	Operate DC welder.	2.8
q.	Build up iron parts.	2.7
r.	Weld cast iron.	2.6
s.	Punch holes.	2.5
t.	Cut with arc.	2.5
u.	Heat with carbon arc torch.	2.3
v.	Braze with carbon arc torch.	2.2
w.	Weld aluminum.	2.2
x.	Operate metal inert gas (MIG) welder.	2.0
y.	Operate tungsten inert gas (TIG) welder.	1.7
7.	Operate an oxy-acetylene welder.	<u>3.0</u>
a.	Check for leaks.	3.4
b.	Shut off equipment.	3.4
c.	Turn on equipment.	3.4
d.	Adjust pressure regulator.	3.3
e.	Change cylinder.	3.3
f.	Light and adjust flame.	3.3
g.	Cut with cutting torch.	3.3
h.	Clean tips.	3.3
i.	Choose proper tip size.	3.2
j.	Run bead with rod.	3.0
k.	Braze thin metal.	3.0
l.	Apply hard surfacing material.	3.0
m.	Run flat beads.	2.9
n.	Braze cast iron.	2.9
o.	Make butt weld.	2.8
p.	Make fillet welds.	2.8
q.	Build up iron parts with bronze.	2.8
r.	Make lap welds.	2.8
s.	Run vertical beads.	2.7
t.	Run bead without rod.	2.7
u.	Run overhead beads.	2.6
8.	Perform skills for hot and cold metal work.	<u>2.4</u>
a.	Cut thread with tap and die.	3.0
b.	Drill holes.	3.0
c.	Use files.	2.9
d.	Identify metals.	2.8
e.	Cut with tin snips.	2.8
f.	Solder metal.	2.7
g.	Cut with cold chisel.	2.7
h.	Cut with hand hack saw.	2.6
i.	Bend metal.	2.6
j.	Use and maintain soldering copper.	2.5
k.	Use power hack saw.	2.4
l.	Form sheet metal joints.	2.3
m.	Anneal, harden, and temper metal.	2.3
n.	Draw-out metal.	2.1

o.	Up-set metal.	1.9
p.	Operate metal-working lathe.	1.8
q.	Operate gas forge.	1.5
r.	Operate coal forge.	1.3
9.	Learn skills for concrete and masonry work.	<u>2.5</u>
a.	Pour concrete.	2.8
b.	Trowel concrete.	2.8
c.	Protect concrete while curing.	2.8
d.	Reinforce concrete.	2.8
e.	Mix concrete.	2.8
f.	Build and prepare forms.	2.7
g.	Remove forms.	2.7
h.	Embed bolts.	2.7
i.	Edge concrete.	2.6
j.	Drill holes in concrete.	2.5
k.	Treat forms.	2.4
l.	Lay concrete blocks.	2.3
m.	Test aggregates for impurities.	2.1
n.	Lay brick.	1.9
10.	Operate and maintain farm engines.	<u>3.3</u>
a.	Change oil and oil filters.	3.6
b.	Service air and fuel filters.	3.6
c.	Maintain battery water.	3.6
d.	Start and operate both gas and diesel engines properly.	3.6
e.	Read and follow operator's manuals.	3.5
f.	Remove and connect battery cables.	3.5
g.	Charge batteries.	3.4
h.	Troubleshoot and identify fuel problems.	3.3
i.	Troubleshoot and identify ignition problems.	3.3
j.	Maintain and operate small gas engines (2 and 4 cycle).	3.1
k.	Identify engine components and systems.	3.1
l.	Determine voltage of batteries.	3.0
m.	Read battery hydrometer.	3.0
11.	Learn minor tuneup and repairs for farm engines.	<u>2.5</u>
a.	Clean, gap, and replace spark plugs.	3.5
b.	Clean, install, and gap breaker points.	3.3
c.	Install condensers.	3.3
d.	Adjust carburetor mixture and speed screws.	3.0
e.	Time engines using timing light.	2.9
f.	Set float levels in carburetors.	2.8
g.	Disassemble and reassemble distributors.	2.7
h.	Set breaker point dwell using a dwell meter.	2.7
i.	Measure compression.	2.6
j.	Adjust valves.	2.6

k.	Measure vacuum.	2.6
l.	Replace solenoids and bendix gears.	2.5
m.	Clean brush holders and install brushes.	2.4
n.	Disassemble and clean starting motors.	2.4
o.	Test and replace coils.	2.3
p.	Test fuel pumps.	2.3
q.	Rebuild carburetors.	2.3
r.	Clean commutator bars.	2.1
s.	Operate distributor testing machine.	2.1
t.	Test injector on diesel engines.	2.1
u.	Repair alternators.	2.0
v.	Test generator with growler.	1.9
w.	Operate exhaust analyzer.	1.6
12.	Overhaul and repair farm engines.	<u>2.2</u>
a.	Torque cylinder head bolts.	2.5
b.	Replace pan and gasket assemblies.	2.4
c.	Overhaul engines.	2.4
d.	Remove and inspect cylinder heads.	2.4
e.	Install and torque main bearings and rod caps.	2.3
f.	Assemble and install cylinder heads.	2.3
g.	Remove piston assembly.	2.3
h.	Hone cylinders.	2.3
i.	Replace piston rings.	2.2
j.	Install oil pump.	2.2
k.	Ream cylinder ridge.	2.2
l.	Install timing gear and/or chains.	2.2
m.	Install piston assembly.	2.2
n.	Determine valve stem guide clearance.	2.2
o.	Replace rocker arms.	2.2
p.	Check piston ring end gap.	2.2
q.	Install crankshaft.	2.2
r.	Measure ring band clearance.	2.2
s.	Replace valve guides.	2.2
t.	Grind valves; reface valves and valve seats.	2.2
u.	Measure cylinder taper and roundness.	2.1
v.	Replace hydraulic valve lifters.	2.1
w.	Use plastigage, micrometers, and other measuring devices to determine wear and/or clearance.	2.1
x.	Test valve springs.	2.1
13.	Operate and maintain trucks and tractors.	<u>3.2</u>
a.	Keep fuel and lubricants clean.	3.6
b.	Operate tractors (wheeled).	3.6
c.	Maintain oil level in tractor hydraulic systems.	3.6
d.	Lubricate trucks and tractors.	3.6
e.	Test anti-freeze.	3.4
f.	Service cooling systems.	3.3
g.	Repack and adjust front wheel bearings.	3.2

h.	Adjust brakes.	3.2
i.	Service tires.	3.2
j.	Adjust clutches.	3.1
k.	Load and unload trucks by hand or with mechanical devices (hoists, lifts, winches, etc.).	3.1
l.	Install wheel weights.	2.9
m.	Remove and mount tractor tires.	2.9
n.	Adjust steering mechanisms.	2.9
o.	Operate tractors (tracked).	2.4
14.	Make minor repairs on trucks and tractors.	<u>2.6</u>
a.	Check and replace water hoses.	3.2
b.	Pack wheel bearings.	3.2
c.	Test and replace fan belts.	3.2
d.	Replace thermostats.	3.1
e.	Clean radiators and cooling systems.	3.0
f.	Replace water pumps.	3.0
g.	Replace oil seals.	3.0
h.	Bleed brake lines.	3.0
i.	Install brake linings.	2.8
j.	Replace voltage regulators.	2.8
k.	Test radiator pressure caps.	2.7
l.	Adjust voltage regulators.	2.5
m.	Service power steering units.	2.5
n.	Service engine governor and linkage.	2.5
o.	Operate steam cleaner or high pressure cleaner.	2.4
15.	Learn the hydraulic systems of trucks and tractors.	<u>2.6</u>
a.	Stop leaks in hydraulic systems.	3.1
b.	Clean hydraulic system breather cap or air vent.	3.0
c.	Drain, clean, flush, and refill hydraulic system.	3.0
d.	Clean and replace hydraulic lines.	3.0
e.	Replace hydraulic "O" rings.	2.9
f.	Replace hydraulic fittings.	2.9
g.	Troubleshoot hydraulic systems.	2.9
h.	Install hydraulic hose connections.	2.9
i.	Bleed hydraulic systems.	2.8
j.	Maintain hydraulic cylinders.	2.8
k.	Clean hydraulic system orifices.	2.7
l.	Clean hydraulic relief valves.	2.5
m.	Analyze malfunctions of hydraulic pumps.	2.5
n.	Service and repair external hydraulic pumps.	2.5
o.	Repair hydraulic cylinders.	2.5
p.	Service hydraulic motors.	2.4
q.	Determine hydraulic cylinder lift force.	2.2
r.	Repair hydraulic motors.	2.2
s.	Operate a hydraulic tester.	2.2

t.	Service and repair internal hydraulic pumps.	2.2
u.	Determine hydraulic cylinder displacement.	2.1
16.	Operate and maintain farm machinery.	<u>3.2</u>
a.	Read and follow operators' manuals.	3.6
b.	Know and comply with safety rules relating to the operation of each piece of farm machinery.	3.6
c.	Make operating adjustments.	3.5
d.	Hitch implements.	3.4
e.	Adjust V-belts for tension.	3.4
f.	Repair equipment under field conditions.	3.4
g.	Clean planting equipment.	3.4
h.	Lubricate field machines.	3.3
i.	Clean fertilizer equipment.	3.3
j.	Replace bearings and races.	3.3
k.	Read and follow technical service manuals.	3.2
l.	Repair roller and hook-link chains.	3.1
m.	Operate field machines.	3.1
n.	Recondition worn equipment.	3.1
o.	Calibrate field machines.	2.8
p.	Troubleshoot machines.	2.7
q.	Store equipment.	2.7
r.	Assemble new machinery.	2.7
s.	Construct machinery and equipment.	2.6
t.	Determine field efficiency of machines.	3.0
17.	Repair power systems.	<u>3.0</u>
a.	Attach and maintain P.T.O. shaft.	3.3
b.	Adjust belt tension.	3.2
c.	Service shafts and universal joints.	3.2
d.	Adjust sprocket chains and wheels.	3.1
e.	Adjust belts and pulleys for proper speed.	3.1
f.	Size and replace belts/V belts.	3.1
g.	Service flexible shafts.	3.0
h.	Measure shaft R.P.M. with a tachometer.	2.6
i.	Splice flat belts.	2.1
18.	Learn rural electrification skills.	<u>2.9</u>
a.	Use safety measures in electrical wiring.	3.5
b.	Select correct fuse sizes.	3.2
c.	Replace fuses.	3.2
d.	Make splices.	3.0
e.	Repair electrical cords.	3.0
f.	Wire on-off switches.	2.9
g.	Select wire sizes.	2.9
h.	Know electrical terminology such as: volts, amps, watts, ohms.	2.9
i.	Attach wires to terminals.	2.9
j.	Solder splices.	2.8

k.	Install wire nut connectors.	2.8
l.	Install light fixtures.	2.8
m.	Install electric motors.	2.8
n.	Wire buildings and structures.	2.6
o.	Wire three-way switches.	2.6
p.	Wire four-way switches.	2.3
19.	Operate and maintain electric motors.	<u>2.5</u>
a.	Start and stop large electric motors properly to prevent damage to pumps, grinders, mixers, etc.	2.9
b.	Maintain electric motors.	2.8
c.	Identify and select electric motors.	2.7
d.	Figure electric motor pulley size and speeds.	2.5
e.	Change direction of rotation of electric motors.	2.4
f.	Check amperage draw under load.	2.4
g.	Change electric motors from 120 volts to 240 volts or vice versa.	2.2
h.	Repair electric motors.	2.1
20.	Learn home convenience and sanitation skills.	<u>2.6</u>
a.	Repair leaky faucets.	2.9
b.	Assemble pipe and pipe fittings.	2.9
c.	Thread pipe.	2.9
d.	Measure and cut pipe.	2.9
e.	Cut plastic tubing/pipe.	2.9
f.	Install plastic tubing/pipe.	2.9
g.	Flare copper tubing.	2.8
h.	Cut copper tubing.	2.8
i.	Ream pipe.	2.8
j.	Install fixtures on plastic pipe.	2.8
k.	Sweat joints on copper pipe.	2.6
l.	Adjust air control mechanism on pressure system.	2.5
m.	Install pressure pumps.	2.5
n.	Cut soil pipe.	2.4
o.	Install water heaters.	2.4
p.	Repair pumps.	2.4
q.	Caulk joints on soil pipe.	2.3
r.	Lay soil pipe.	2.2
s.	Cut and install glass.	2.2
t.	Measure, cut, and install fiberglass or plexiglass.	2.2
u.	Service septic tanks.	2.1
21.	Use surveying equipment and do surveying.	<u>2.3</u>
a.	Measure fields with wheels, tapes, chains, or A-frames.	2.6
b.	Set up the farm level.	2.5

c.	Read surveying rod.	2.4
d.	Lay out lines to grade.	2.4
e.	Determine elevations with farm level.	2.4
f.	Lay out building foundations with farm level.	2.4
g.	Measure slope with farm level.	2.3
h.	Read contour maps.	2.3
i.	Lay out contour lines.	2.2
j.	Make contour maps.	1.8
22.	Perform skills used in irrigation and drainage.	<u>2.2</u>
a.	Start irrigation pump.	2.5
b.	Set up and move irrigation pipe.	2.4
c.	Pack and adjust packing glands on pump.	2.4
d.	Measure water through gates or weirs.	2.3
e.	Calculate amount of water applied.	2.3
f.	Repair sprinkler heads.	2.3
g.	Lay out irrigation systems.	2.2
h.	Install drainage tile.	1.9
i.	Construct terraces.	1.8
j.	Construct reservoirs.	1.7
23.	Build and repair farm fences.	<u>3.1</u>
a.	Brace corner posts.	3.3
b.	Repair fences.	3.3
c.	Stretch wire.	3.3
d.	Secure wire to posts.	3.2
e.	Splice wire.	3.2
f.	Set posts.	3.2
g.	Build wire gates.	3.2
h.	Set steel posts.	3.2
i.	Dig post holes.	3.1
j.	Lay out fence lines.	3.1
k.	Anchor fence lines.	3.1
l.	Trouble shoot electric fences.	3.0
m.	Install electric fences.	3.0
n.	Install manufactured gates.	3.0
o.	Install fences across water gaps and ditches.	3.0
p.	Use power posthole digger.	2.9
q.	Treat fence posts.	2.3
24.	Repair and construct farm buildings.	<u>2.8</u>
a.	Repair farm buildings.	3.1
b.	Evaluate existing buildings for repairs or remodeling.	2.9
c.	Estimate costs of new buildings.	2.7
d.	Construct or assist in constructing large buildings.	2.7

e. Plan new buildings.	2.7
25. Repair and construct livestock equipment.	<u>2.5</u>
a. Construct livestock handling equipment.	2.8
b. Use and maintain livestock spraying equipment.	2.8
c. Maintain and sharpen clippers and shears.	2.4
d. Clean, oil, and preserve leather.	2.3
e. Make rope halters.	2.2

SETUP MECHANIC OF FARM AND INDUSTRIAL EQUIPMENT

Other Titles: Farm Mechanic, Field Equipment -
Farm Maintenance Mechanic.

Job Description:

Services, adjusts, and makes minor repairs on farm vehicles, machinery, and equipment, such as tractors, trucks, automobiles, harvesters, combines, silo fillers, plows, and similar equipment. Using hand tools: observes and examines machinery and parts in operation to detect malfunctioning or defective units. Replace component, such as carburetors, fuel pumps, generators, ignition points, and spark plugs. Adjusts timing of motors, lubricates, washes, paints, and cleans vehicles and attachments. May assist other workers in more complex maintenance tasks, such as overhaul of machinery and equipment, repair and erection of buildings and structures, plumbing repair, and electrical work on the farm.

Competencies Identified and Validated

N = 29*		Weighted Mean**
<u>Competencies</u>		
1.	Maintain and service power machinery systems.	
a.	Change oil and filter.	3.6
b.	Check coolant freezing point.	3.6
c.	Lubricate all types of equipment.	3.5
d.	Service air cleaners, dust unloading valves and precleaners.	3.3
e.	Service or replace batteries and cables.	3.2
f.	Recommend oils and lubricants for all types of machinery.	3.1
g.	Prepare cooling system for cold weather.	3.1
h.	Demonstrate safety rules for handling tractor fuel.	3.0
i.	Identify sources of contamination of oil.	2.7
j.	Describe operation of hydrostatic transmission.	2.2
2.	Repair hydraulics.	
a.	Remove, clean, and replace hydraulic filters.	3.3
b.	Recommend schedule for replacing filters.	2.9
c.	Remove and replace telescoping hydraulic cylinders.	2.8

* Responses from 29 Farm Equipment Dealerships in 4 states. Survey conducted by Department of Agricultural Education, University of Missouri, Columbia, Missouri 65201.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

3. Maintain and adjust planting equipment systems.
 - a. Calibrate planter for row width and population. 3.2
 - b. Remove and replace furrow openers. 2.8
 - c. Set up grain drill delivered from factory. 2.7
 - d. Prepare grain drill for storage. 2.7
 - e. Adjust planter to different planting depths. 2.6
 - f. Install fertilizer hose. 2.5
 - g. Set up planter delivered from factory. 2.4
 - h. Select and install correct seed plates. 2.4
 - i. Calibrate hydraulic transport and leveling system. 2.4
 - j. Clean and service planters for storage. 2.4
 - k. Recommend seed drum for specific conditions. 2.3
 - l. Service and adjust fluted and double run feed drills. 2.3
 - m. Recommend speed at which planter is to be driven. 2.2
 - n. Install and service no-till coulters. 2.2
 - o. Repair and adjust fertilizer drill. 2.2
 - p. Prepare drill and seeder for storage. 2.2
 - q. Calibrate planter fertilizer rate. 2.1
 - r. Install and calibrate herbicide and insecticide attachments. 2.1
 - s. Install grass seed attachment. 2.1
 - t. Repair and adjust grass seeder. 2.0
 - u. Test accuracy of acremeter. 1.9
4. Maintain and adjust tillage equipment systems.
 - a. Set up plow delivered from factory. 3.2
 - b. Assemble cultivator. 3.1
 - c. Align sweeps for proper tillage. 3.1
 - d. Adjust for proper trailing and furrow filling. 3.1
 - e. Service and adjust tandem disc. 3.0
 - f. Adjust attachments for best tillage situation. 2.9
 - g. Set up folding gangs. 2.8
 - h. Set up carrier for cultivators. 2.7
 - i. Recommend tool arrangement. 2.6
 - j. Set up spring or spike tooth harrow. 2.6
 - k. Set up rotary hoe. 2.6
 - l. Prepare plow for storage. 2.5
5. Maintain and adjust combine systems.
 - a. Adjust cylinder and concave. 3.0
 - b. Troubleshoot thrashing system. 2.9
 - c. Adjust straw walkers. 2.9
 - d. Inspect and repair sickle bar, knives, guards, and wear plates. 2.9
 - e. Clean and service grain and tailing elevators. 2.8

f.	Adjust and service boot grain supply augers.	2.8
g.	Adjust and service cleaning unit.	2.8
h.	Inspect and service separating unit.	2.8
i.	Attach platform and grain feeder to separator.	2.7
j.	Adjust auger height.	2.7
k.	Remove and replace unloading auger.	2.6
l.	Adjust rear axle to desired width.	2.4
m.	Adjust reel speed to specific crop condition.	2.4
n.	Condition combine for storage.	2.3
o.	Troubleshoot cutting problems.	
6.	Maintain and adjust forage harvesting systems.	
a.	Time the baler and test by hand.	2.9
b.	Service and adjust knotter.	2.8
c.	Assemble baler shipped from factory.	2.7
d.	Adjust shear bar to specification.	2.7
e.	Align and adjust cutting bar.	2.6
f.	Remove and replace sickle knives, guards, and wear plates.	2.5
g.	Adjust or replace lifting mechanism.	2.5
h.	Service or replace shearing safety mechanism.	2.5
i.	Remove and replace cylinder knives.	2.5
j.	Replace rake teeth.	2.4
k.	Install and adjust swath deflectors.	2.4
l.	Clean and lubricate baler for storage.	2.4
m.	Inspect and service auger.	2.4
n.	Install and service bale injector.	2.4
o.	Adjust tying mechanism or wire tie.	2.4
p.	Service and repair twine wrapping mechanism.	2.4
q.	Set up table for efficient cleaning.	2.3
r.	Service hydraulic bale compression system.	2.3
s.	Adjust for correct bale density and diameter.	2.3
t.	Recommend correct tensions for baler.	2.3
u.	Repair or replace forage deflects.	2.2
v.	Recommend adjustment for adequate cleaning of ground.	2.2
w.	Adjust or replace inner or outer mower shoe.	2.2
x.	Install wagon hitch or baler.	2.1
y.	Install or repair bale counter.	2.1
z.	Service and adjust pickup conveyor.	2.1
aa.	Align by strippers with rake teeth.	2.0
bb.	Adjust reel speed.	2.0
7.	Perform general shop tasks.	
a.	Read and assemble machinery from drawings.	3.6
b.	Identify parts from drawings.	3.6
c.	Set up machines using shop manual.	3.4
d.	Preservice machinery.	3.3
e.	Fill out a job ticket.	3.2
f.	Operate a steam cleaner and a high pressure washer.	3.2

g.	Check shipping invoice from drawings.	3.1
h.	Attach and read an electric tachometer.	3.1
i.	Pickup and deliver machinery.	3.0
j.	Cut and heat with oxyacetylene welder.	2.7
k.	Sketch a layout from designed plans.	2.6
l.	Select welding electrode for specific jobs.	2.6
m.	Butt and fillet weld in all positions with arc welder.	2.4
8.	Maintain shop safety.	
a.	Wear eye and hearing protection.	3.9
b.	Use power hand tools safely.	3.8
c.	Store combustible materials safely.	3.8
d.	Install and adjust safety guards on machinery.	3.7
e.	Use high pressure fluids safely.	3.7
f.	Store chemicals correctly.	3.6
g.	Ventilate engine while running.	3.5
h.	Select proper fire extinguisher for type of fire.	3.5
i.	Administer first aid prior to medical treatment.	3.4
j.	Use standard hand signals in high noise areas.	3.4
k.	Read and interpret safety signs, symbols, and color codes.	3.4
l.	Provide adequate lighting.	3.3
m.	Use compressed air safely.	3.0

TRACTOR MECHANICS HELPER

Job Description:

Tractor Mechanics helper assists tractor mechanic in repairing tractors and tractor components, using hand tools: installs jacks and hoists to raise equipment and lift dismantled assemblies. Disassembles and assembles tractor parts, using machines, hand tools. Clean tools and parts with naphtha, gasoline, or other cleaning compounds. May wash and lubricate equipment. Performs other duties as described under helper.

Competencies Identified and Validated

N = 32*		Weighted Mean**
<u>Competencies</u>		
1.	Maintain and repair engine system.	
a.	Remove and replace rings.	4.0
b.	Time internal components.	3.4
c.	Remove and replace cylinder head.	3.1
d.	Inspect and clean cylinder block.	3.1
e.	Remove and replace crankshaft bearing.	3.1
f.	Remove and replace main bearings.	2.9
g.	Inspect milled surfaces of cylinder block and head.	2.8
h.	Remove and replace sleeve.	2.8
2.	Maintain and repair electrical system.	
a.	Clean, gap, and test spark plugs.	2.9
b.	Set ignition timing.	2.8
c.	Service or replace battery cables.	2.8
d.	Inspect secondary circuit leaks, plug wires, distributor caps, and rotor.	2.6
e.	Diagnose spark plug conditions and recommend head ranges.	2.3
f.	Replace windshield wiper mechanisms or controls.	2.3
g.	Strobe distributor and modify or correct advance curve.	1.8
3.	Maintain and repair fuel delivery system.	
a.	Adjust carburetor for load.	3.4
b.	Install carburetors.	2.8

* Responses from 32 Farm Equipment Dealerships in 5 states. Survey conducted by the Department of Agricultural Education, University of Missouri, Columbia, Missouri 65201.

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c.	Bleed air from diesel fuel system.	2.8
d.	Adjust carburetor for idle.	2.7
e.	Test pressure of transfer pump.	2.7
f.	Test injector for opening pressure.	2.6
g.	Adjust carburetor for best fuel economy.	2.5
h.	Clean carburetor.	2.5
i.	Repair or replace gasoline carburetor.	2.5
j.	Test injector for valve seat leakage.	2.4
k.	Test injector for spray pattern.	2.4
l.	Test injector for nozzle leak back.	2.4
m.	Repair and replace fuel injector.	2.4
n.	Adjust floating setting to specification.	2.3
o.	Install and time the injection pump.	2.3
p.	Adjust governor.	2.3
q.	Repair and replace injector nozzle.	2.2
r.	Troubleshoot gasoline carburetor problem.	2.1
s.	Diagnose injector problems.	2.1
t.	Clean, inspect, and diagnose wear of injector nozzle.	2.1
4.	Maintain and repair intake and exhaust systems.	
a.	Remove and replace valves.	2.8
b.	Remove and replace rocker arm.	2.6
c.	Inspect and replace valve spring.	2.4
d.	Inspect and replace cam followers.	2.4
e.	Inspect and replace valve rotators.	2.3
f.	Recondition valve face and seat.	2.3
g.	Diagnose turbochargers - superchargers problems.	1.7
h.	Inspect and replace turbocharger impeller.	1.5
i.	Measure bearing clearance of turbocharger.	1.4
5.	Maintain and repair lubrication system.	
a.	Test engine oil pressure.	2.9
b.	Service crankcase ventilation system.	2.6
c.	Repair and replace crankcase ventilation system.	2.6
d.	Test oil relief pressure valve.	2.4
e.	Inspect and replace bushings and bearings.	2.4
f.	Clean and adjust pressure regulating valve.	2.3
g.	Identifying and diagnosing oil pressure problems.	2.3
h.	Diagnose lubrication system failure.	2.1
i.	Identify sources of contamination of oil.	2.1
6.	Maintain and repair cooling system.	
a.	Identify internal coolant leakage.	2.3
7.	Maintain and repair mechanical transmission system.	
a.	Separate engine from clutch housing.	3.2
b.	Align transmission with engine.	2.8
c.	Adjust clutch linkage.	2.8
d.	Replace oil seals and oil slinger rings.	2.6

e.	Remove and replace spring-loaded clutch.	2.6
f.	Remove and replace bearings.	2.5
g.	Remove and replace bushings.	2.5
h.	Remove and replace worn or scuffed gears.	2.5
i.	Clean splines and test for wear.	2.4
8.	Repair hydraulics.	
a.	Remove and replace seals in the hydraulic system.	2.6
b.	Test opening pressure of valves.	2.5
c.	Troubleshoot malfunction of cylinder.	2.4
d.	Remove and replace pressure control valves.	2.3
9.	Maintain and repair brake system.	
a.	Remove and replace disk brakes assembly.	2.5
10.	Maintain and repair final drive system.	
a.	Adjust pinion mesh according to specifications.	3.0
b.	Remove and replace seals in final drive.	2.6
c.	Remove and replace axle.	2.6
d.	Replace pinion and ring gear in final drive.	2.3
e.	Troubleshoot cause of excessive wear on final drive.	2.1
f.	Adjust backlash in final drive.	2.0
11.	Perform general shop tasks.	
a.	Safely store combustible materials.	3.4
b.	Heat with oxyacetylene.	3.2
c.	Set up and operate dynamometer.	3.0
d.	Take measurement and read micrometer.	2.9
e.	Fusion weld with oxyacetylene.	2.8
f.	Recondition and sharpen hand tools.	2.8
g.	Take measurement and read dial indicator.	2.8
h.	Attach and read dwell meter.	2.7
i.	Take measurement and read plastigauge.	2.7
j.	Remove broken stud bolts.	2.7
k.	Butt weld with electric arc.	2.3
l.	Fillet weld with electric arc.	2.3
m.	Select welding electrodes for specific jobs.	2.2
n.	Vertical weld with electric arc.	2.2
o.	Weld cast iron with oxyacetylene.	2.2
p.	Cut with oxyacetylene.	2.2
q.	Horizontal weld with electric arc.	2.0
r.	Over head weld with electric arc.	2.0
s.	Inspect gears and determine tolerance.	2.0
t.	Braze with oxyacetylene.	1.9
u.	Cut with electric arc.	1.8
v.	Use safety procedures with welding.	1.8

12. Maintain shop safety.

a.	Read and interpret color codes.	3.8
b.	Store chemical correctly.	3.8
c.	Use power hand tools safely.	3.6
d.	Use compressed air safely.	3.6
e.	Use personal protective equipment.	3.5
f.	Provide adequate lighting.	3.5
g.	Wear eye protection.	3.5
h.	Store combustible material safely.	3.4
i.	Select proper fire extinguishers for type of fire.	3.4
j.	Read and interpret safety signs and symbols.	3.3
k.	Ventilate engines while running.	3.3
l.	Install and adjust guards on equipment.	3.3
m.	Install and adjust guards on machinery.	3.3
n.	Administer first aid prior to medical treatment.	2.9
o.	Use standard hand signals in high noise areas.	2.9
p.	Wear hearing protection.	2.8
q.	Test electrical circuits and switches.	2.5

PARTSMAN IN FARM MACHINERY DEALERSHIP

Other Titles: Partsman, Farm Machinery Partsman.

Job Description:

A Partsman in a farm machinery dealership is responsible for the selling of spare and replacement parts to customers and dispensing replacement parts for service jobs. A Partsman is responsible for receiving, storing, and maintaining an inventory of machinery parts. The partsman must be able to identify parts, determine parts numbers, and determine prices. Continual contact with customers through sales requires that a Partsman be able to work harmoniously with customers to maximize customer satisfaction.

Competencies Identified and Validated

N = 30*		Weighted Mean**
Competencies		
1.	Learn parts sales techniques.	3.3
a.	Determine price of part from price lists.	3.8
b.	Sell parts to customers.	3.8
c.	Make out sales receipts.	3.8
d.	Use parts catalog or microfilm to determine part name and stock numbers.	3.8
e.	Read and interpret diagrams in parts manuals.	3.7
f.	Receive telephone orders for parts.	3.6
g.	Determine the make, model, year, and type of equipment for which a part is needed.	3.6
h.	Record parts identification and price on service tickets.	3.6
i.	Make out credit slips and re-stock returned parts.	3.5
j.	Locate and retrieve parts from storage area.	3.5
k.	Advise customers when out-of-stock parts will be available.	3.5
l.	Determine that any new parts returned for credit are complete and undamaged.	3.4
m.	Advise customers of parts needed.	3.4
n.	Advise customers of related parts, accessories, and consumable items that may be needed.	3.4
o.	Sell related parts, accessories, and consumable items to customers.	3.4

* Responses from 30 Farm Machinery Dealers in 9 states. Survey conducted by Agricultural and Occupational Education Division of the Education Department, Cornell University, Ithaca, New York 14853.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

p.	Interpret serial numbers to identify model of equipment for which a part is needed.	3.3
q.	Refer customers to salesperson for major equipment purchases.	3.3
r.	Identify parts needed by service department from verbal description.	3.3
s.	Dispense parts to service department.	3.3
t.	Guide customers to location of serial and parts numbers on equipment.	3.2
u.	Explain parts warranty and guarantee provisions to customers.	3.2
v.	Encourage multiple purchases of consumable items.	3.1
w.	Explain dealer policy to customers.	3.1
x.	Use adding machine to total prices.	3.1
y.	Provide customer refunds or exchanges under manufacturer's warranties or dealership guarantees.	3.0
z.	Check credit references of customers.	2.8
aa.	Operate cash register to record sales.	2.8
bb.	Refer customers to other dealers for parts not in current inventory or discontinued.	2.7
cc.	Refer customers to shop for evaluation of warranty coverage on parts returned.	2.6
cd.	Advise customers on procedure for installation of parts.	2.4
2.	Learn warehousing and merchandising systems.	<u>2.8</u>
a.	Store parts in stockroom according to dealership inventory system.	3.7
b.	Arrange stockroom for efficient use.	3.4
c.	Display new and fast moving items.	3.2
d.	Stock self-service shelves with consumable items.	3.0
e.	Prepare and maintain displays of tools and accessories.	2.6
f.	Put price tags on displayed items.	2.5
g.	Assemble small equipment such as chainsaws, mulchers, etc.	1.4
3.	Use processing and shipping skills.	<u>3.3</u>
a.	Unpack and check items received against invoices.	3.8
b.	Resolve any shortages, damaged, or wrong items in shipments received.	3.8
c.	Make out invoices for items to be shipped.	3.5
d.	Mail or ship parts to fill customer orders.	3.4
e.	Ship warranty claim parts to manufacturer for credit.	3.3
f.	Package parts for shipping.	3.3

g.	Ship defective parts to manufacturer for credit.	3.3
h.	Ship parts via least cost carrier.	3.1
i.	Ship exchange parts to manufacturer for rebuilding.	3.0
j.	Arrange for insurance on shipments according to dealership policies.	2.9
k.	Compute postage and freight for parts shipment.	2.8
4.	Control inventory.	<u>2.9</u>
a.	Use rush orders for breakdown parts.	3.8
b.	Order out-of-stock parts for customers and repair jobs in shop.	3.7
c.	Maintain current inventory of parts on control cards or computer printout.	3.5
d.	Identify fast moving parts for inventory increases.	3.5
e.	Order parts based on actual and anticipated sales.	3.3
f.	Order parts to take advantage of volume discounts.	3.2
g.	Identify new parts in excess of inventory.	3.1
h.	Conduct annual parts inventory for tax purposes.	3.1
i.	Maintain current tool and hardware inventory.	2.8
j.	Survey wholesalers for best prices and service.	2.8
k.	Dispose of obsolete parts.	2.8
l.	Use computer to locate parts in other dealerships.	2.5
m.	Calculate and analyze inventory turnover.	2.5
n.	Make out computer cards for parts orders.	2.3
o.	Purchase tools and hardware from salesperson.	1.7
p.	Cooperate in volume buying with other dealers.	1.5
5.	Keep records.	<u>2.4</u>
a.	Maintain complete and current parts catalogs and price lists.	3.7
b.	Adjust parts catalogs to reflect manufacturer's service bulletins.	3.4
c.	File sales slips as a record of sales.	2.4
d.	Prepare periodical sales reports for management.	2.0
e.	Maintain customer credit records.	2.0
f.	Maintain customer files relating to sales.	1.7
g.	Process tax exemption data for individual customers.	1.7
6.	Maintain an attractive parts department.	<u>3.3</u>
a.	Keep parts department clean, neat, and attractive.	3.6
b.	Maintain equipment and furniture.	3.0

7.	Practice good management.	<u>2.9</u>
a.	Predict seasonal needs for parts and consumable items.	3.2
b.	Advise management on inventory level for parts and consumable items.	3.1
c.	Designate excess and obsolete parts.	3.0
d.	Advise management in determining parts storage space requirements.	2.9
e.	Set prices for items not on manufacturer's price lists.	2.8
f.	Advise management on dealership policy for the parts department.	2.5
g.	Determine price discounts for wholesale and volume sales.	2.5
8.	Develop good work habits and attitudes.	<u>3.6</u>
a.	Honesty and personal integrity.	3.9
b.	Follow dealership policies and procedures.	3.8
c.	Follow directions.	3.8
d.	Courtesy in dealing with customers.	3.8
e.	Initiative for job.	3.7
f.	Dependability and thoroughness in job preferences.	3.7
g.	Accept and carry out responsibility.	3.7
h.	Willingness to learn.	3.7
i.	Harmonious working relationship with co-workers.	3.7
j.	Clean, neat, and well-groomed appearance.	3.6
k.	Positive attitude toward job.	3.6
l.	Enthusiasm for job.	3.6
m.	Perform work assignments to the best of ability.	3.6
n.	Punctuality on job.	3.6
o.	Cooperativeness on the job.	3.6
p.	Regular attendance.	3.6
q.	Loyalty to employer.	3.6
r.	Accept and profit from constructive criticism.	3.5
s.	Follow dealership safety procedures and policies.	3.5
t.	Flexibility to change.	3.4
u.	Willingness to work overtime when needed.	3.4
v.	Alert customers and others to hazardous situations.	3.4
w.	Observe situations or conditions creating hazards.	3.4
x.	Advise management about existing safety hazards, and work to correct them.	3.4
y.	Careful use of tools.	3.1

SMALL ENGINE MECHANIC

Other Titles: Lawn Mower Mechanic, Garden Tractor Mechanic, Mechanic

Job Description:

Persons in this occupation are involved in the care and repair of small gasoline engines. They assemble, disassemble, trouble-shoot and repair small engines up to 20 hp. They are responsible for their tools and keeping job time and parts for the repairs completed. They are also responsible for demonstrating the repaired engines to customers.

Competencies Identified and Validated

N = 31*		Weighted
Competencies		Mean**
1. Have proficient use of written and oral communication.		<u>3.3</u>
a. Can communicate with customers.		3.6
b. Have high school degree or passed equivalent examination.		2.9
c. Neat appearance. #		
d. Can receive communication from supervisor. #		
e. Complete warranty claims forms. #		
2. Use and maintain parts and service manuals.		<u>3.6</u>
a. Follow written repair instructions.		3.7
b. Locate the proper manuals and specifications for specific equipment.		3.6
c. Read and interpret sketches and diagrams.		3.6
d. Use common sense. #		
e. Use microfiche machine. #		
3. Can use basic office procedures.		<u>2.6</u>
a. Use the telephone.		2.9
b. Be familiar with office forms.		2.6
c. Maintain file of office forms.		2.1
4. Use and maintain hand and power tools.		<u>3.2</u>
a. Select the proper hand tools.		3.7
b. Store and maintain tools.		3.5
c. Adjust tools.		3.5

* Responses from 31 Small Engine Repair Shops in 21 states. Survey conducted by Agricultural Engineering Department, University of Maryland, College Park, Maryland 20740.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

Not included on questionnaire but recommended by some experts surveyed.

d.	Keep tools clean.	3.5
e.	Interpret tool operation instructions.	3.3
f.	Set up and use special application tools.	3.3
g.	Recondition hand and power tools.	2.6
h.	Recondition minor problems with power tools.	2.6
5.	Proficient in inspecting and diagnosing malfunctions pertaining to small engines.	<u>3.5</u>
a.	Diagnose potential cause of engine failure.	3.6
b.	Use test equipment.	3.5
c.	Recommend parts needed for engine repair.	3.5
d.	Interpret maintenance procedures for customers to prevent operating defects.	3.5
e.	Can operate and visually inspect engines for failure.	3.4
6.	Repair and maintain ignition, charging, and starting systems.	<u>3.5</u>
a.	Check for sparks.	3.7
b.	Inspect breaker points.	3.6
c.	Time ignition system.	3.6
d.	Test the coil or magneto.	3.6
e.	Install and adjust spark plugs.	3.6
f.	Identify parts of system.	3.6
g.	Inspect for poor electrical connections.	3.5
h.	Repair starting, ignition, and charging circuits.	3.5
i.	Repair recoil starting systems.	3.5
j.	Remove and install alternator and regulator.	3.4
k.	Install and service battery.	3.4
l.	Test the generator output.	3.4
m.	Install and adjust bolts.	3.3
n.	Adjust the coil air gap on small engines.	3.2
o.	Test starter armature and field coils.	3.2
p.	Permanent magnet starters. #	
q.	Solid state ignition. #	
7.	Repair and maintain governing systems.	<u>3.3</u>
a.	Adjust for proper engine speed.	3.4
b.	Service or replace parts for governors.	3.2
c.	Inspect parts of governor for defects.	3.1
8.	Understand and maintain lubrication systems.	<u>3.4</u>
a.	Change oil and oil filters.	3.7
b.	Remove and install oil pumps or oil slingers.	3.5
c.	Have a basic understanding of prefixes used to identify lubricants.	3.1
9.	Repair and maintain cooling systems.	<u>3.4</u>
a.	Replace or add filtering screens over air intake.	3.4

Not included on questionnaire but recommended by some experts surveyed.

b.	Clean debris from cooling system.	3.4
10.	Repair and maintain gas and LP fuel systems.	<u>2.9</u>
	<u>Gas systems.</u>	3.4
a.	Service filters.	3.5
b.	Adjust and clean carburetors.	3.4
c.	Remove and install fuel pump, lines, and tanks.	3.4
d.	Clean sediment bowl and screen.	3.4
e.	Install carburetor repair kits.	3.4
f.	Remove and install carburetor manifolds.	3.4
g.	Identify parts of fuel system.	3.2
h.	Test fuel pump pressure.	3.1
	<u>LP Gas.</u>	2.3
i.	Service vaporizer.	2.3
j.	Adjust fuel air mixture.	2.3
k.	Service fuel hoses and valves.	2.3
l.	Check and repair leaks.	2.3
m.	Clean all fuel systems.	2.3
n.	Replace or refill gas cylinder.	2.1
o.	Safety lockoff system (indoor operation). #	
11.	Ability to perform major rebuild of 2 and 4 cycle engines.	<u>3.5</u>
a.	Use torque wrench.	3.7
b.	Check compression.	3.7
c.	Clean and inspect engine and engine parts for defects.	3.7
d.	Install gaskets.	3.6
e.	Remove and install reed valves where it applies.	3.5
f.	Disassemble and reassemble engine and accessories.	3.5
g.	Deglaze and inspect cylinders.	3.5
h.	Service valves, guides and spring.	3.5
i.	Use measuring instrument (micrometers).	3.4
j.	Remove cylinder wall, ridge.	3.3
k.	Identify parts from different engine manufacturers and engine sizes.	3.3
l.	Install and ream camshaft bushings.	3.1
12.	Repair and maintain clutch systems.	<u>3.3</u>
a.	Remove and install clutch assemblies.	3.4
b.	Inspect clutch assemblies for wear.	3.3
13.	Use OSHA prescribed safety procedures within shop.	<u>3.2</u>
a.	Use hand and power tools safely.	3.8

Not included on questionnaire but recommended by some experts surveyed.

- b. Understand portable fire suppression equipment and extinguishers according to OSHA standards. 3.4
- c. Use personal protective equipment according to OSHA standards. 3.3
- d. Understand medical service and first aid procedures according to OSHA standards. 3.0
- e. Use safety color codes and signs for marking physical hazards according to OSHA standards. 2.5

FARM TRACTOR AND EQUIPMENT OPERATOR

Other Titles: Farm Tractor and Machinery Operator,
Farm Machine and Equipment Operator.

Job Description:

This person is responsible for the safe operation, adjustment and maintenance of farm tractors and equipment. The Operator drives and controls the tractors and equipment units to store them out of the weather, perform chores, till the soil, and plant, cultivate, and harvest crops. The individual may have other tasks not related to tractor and equipment operation. The Farm Tractor and Equipment Operator may be self-employed, employed by a farm manager, land owner, tenant farmer, or farm implement dealer.

Competencies Identified and Validated

N = 178*		Weighted Mean**
<u>Competencies</u>		
1.	Understand the components of farm tractor and equipment safety.	3.0
a.	Look and listen for signals from parts of the farm tractor and equipment units which indicate problems, and immediately take appropriate action.	3.7
b.	Study operator's manual carefully, understand the information furnished, and pay particular attention to the safety precautions listed.	3.6
c.	Refuse to have extra riders except in very carefully supervised instructional situations.	3.3
d.	Use tractor and equipment protective equipment as appropriate:	3.3
	(1) Safety stand when working under any tractor or equipment unit.	3.6
	(2) Slow-moving vehicle emblem.	3.5
	(3) Adequate water supply when working around anhydrous ammonia.	3.5
	(4) Shielding and guarding devices.	3.3
	(5) Fire extinguisher.	3.0
	(6) Protective cab or frame and safety belt.	2.9

* Responses from 178 Farm Tractor and Equipment Operators in 28 states. Survey conducted by Department of Agriculture, Illinois State University, Normal, Illinois 61761.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

e.	Take actions which will prevent the following tractor and equipment accidents:	3.3
(1)	Overturns.	3.7
(2)	Second party (helper) accidents.	3.6
(3)	Falls	3.4
(4)	Common tractor and equipment accidents related to the following:	3.2
(a)	Wrap points.	3.5
(b)	Pinch points.	3.3
(c)	Crush points.	3.3
(d)	Free-wheeling parts.	3.3
(e)	Shear points.	3.2
(f)	Thrown objects.	3.2
(g)	Stored energy.	3.1
(h)	Pull-in points.	3.0
(5)	Collisions with other vehicles.	3.1
f.	Learn the various systems for farm tractor and equipment units, and understand the essential functions of each.	3.3
g.	Wear clothing which fits well, is free of dangling parts, and is otherwise safe.	3.3
h.	Be physically, mentally, and psychologically prepared for the work to be performed.	3.2
i.	Learn correct nomenclature for farm tractor and equipment units.	2.9
j.	Know and use the standard hand signals for agriculture as appropriate.	2.5
k.	Use personal protective equipment as appropriate:	1.9
(1)	Safety glasses.	2.2
(2)	Gloves.	2.1
(3)	Ear muffs or ear plugs.	2.1
(4)	Safety shoes.	2.0
(5)	Respirator.	1.7
(6)	Bump cap.	1.7
(7)	Hard hat.	1.6
2.	Follow correct pre-operating procedures.	<u>3.5</u>
a.	Study, learn, and follow the directions given in the farm tractor and equipment unit operators' manuals with regard to appropriate inspecting, servicing, and adjusting tasks.	3.5
b.	Use the correct materials and tools efficiently and safely in performing the appropriate inspecting, servicing, and adjusting tasks.	3.4
3.	Start and stop units properly.	<u>3.2</u>

- a. Follow the procedures for starting and stopping as specified in the farm tractor and/or equipment unit operators' manuals for:
 - (1) Preliminary starting operations. 3.4
 - (2) Actual starting. 3.3
 - (3) Actual stopping. 3.2
 - (4) Checks and adjustments during warm-up. 3.2
 - (5) Preliminary stopping operations. 3.1
 - (6) Procedures after stopping. 3.1
- 4. Control farm tractor and/or equipment unit movement. 3.4
 - a. Follow the procedures for controlling movement specified in the farm tractor and/or equipment unit operators' manuals with special reference to the following:
 - (1) Special situations with certain items of equipment. 3.7
 - (a) Elevators and overhead power lines. 3.7
 - (2) Difficult situations (bad weather, on hills and hillsides, near ditches, being stuck, etc.). 3.6
 - (a) While in motion. 3.7
 - (b) Starting movement. 3.6
 - (b) Stopping movement. 3.6
 - (3) Ordinary situations (good weather, on level, etc.). 3.1
 - (a) While in motion. 3.2
 - (b) Stopping movement. 3.1
 - (c) Starting movement. 3.1
- 5. Hitch and unhitch properly units which require hitching. 3.2
 - a. Follow the procedures for hitching and unhitching specified in the operators' manuals which apply with special reference to the following.
 - (1) Connecting the remote (hydraulic) cylinder. 3.6
 - (2) Hitching rear-mounted tractor equipment. 3.4
 - (3) Connecting the power take-off. 3.3
 - (4) Hitching rules which apply in many situations. 3.3
 - (a) Make sure safety pins are in place and that locks and safety catches are fastened. 3.5

- (b) Use adequate jacks, hoists, or blocks to position equipment. 3.4
 - (c) Be sure wheel width adjustment has been made for the work to be done. 3.2
 - (d) Use proper hardware. 3.2
- (5) Attaching trailing equipment to the tractor drawbar. 3.2
 - (a) Avoid being pinched or crushed by a load-sensing hitch. 3.5
 - (b) Turn engine off and shift to park or set the parking brake before dismounting to hook up. 3.3
 - (c) Have drawbar at correct height. 3.2
 - (d) Position tractor for hitching from the operator's seat. 3.2
 - (e) Shift to park or set the parking brake before permitting a helper (second party) to go behind the tractor to complete the hitch. 3.1
 - (f) Don't try to lift heavy equipment by hand. Use jack or stand. 3.1
- (6) Unhitching equipment. 3.2
 - (a) Lower support stands or jacks, or block up equipment, before the equipment is uncoupled. 3.2
 - (b) Select a good location. 3.1
- (7) Hitching to belt-driven equipment. 2.8
- (8) Hitching where a tractor is not involved. 2.8
- 6. Operate unit correctly under field conditions. 3.3
 - a. Follow the procedures for operating under field conditions as specified in the appropriate operators' manuals with special reference to the following:
 - (1) Follow safety precautions when working on level land, especially near ditches. 3.6
 - (2) Check instruments, and listen and look for trouble. 3.6
 - (3) Be alert for field obstacles. 3.5
 - (4) Follow safety precautions when making short turns. 3.5
 - (5) Turn off engine and disengage all power, then wait until all parts stop before working on tractor or equipment. 3.4
 - (6) Match gear selection and engine speed with load. 3.4

- (7) Make checks before starting field work. 3.3
- (8) Use the correct speed for the operation being done. 3.3
- (9) Follow safe procedures for getting farm tractor or equipment unstuck in the event it becomes stuck. 3.3
- (10) Follow safety precautions when working on slopes. 3.2
- (11) Check efficiency of field operation and take necessary actions. 3.1
- (12) Prevent a farm tractor or equipment unit from getting stuck. 2.9
- 7. Operate unit correctly under highway conditions. 3.7
 - a. Follow the procedures for operating under highway conditions as specified in the appropriate operators' manuals or other authoritative sources.
 - (1) Follow safety precautions. 3.7
 - (2) Obey the laws which apply. 3.6
- 8. Refuel farm tractor or equipment unit correctly. 3.6
 - a. Follow the procedures for refueling specified in appropriate operators' manuals and other authoritative sources with special reference to the following:
 - (1) Avoid fire hazards by not refueling when the engine is hot and not allowing anyone to smoke around the gasoline, diesel, or LP-gas refueling operation. 3.7
 - (2) Keep out dirt and debris. 3.6
 - (3) Keep out moisture. 3.6

FARM EQUIPMENT SALESMAN

Other Titles: Salesman, Farm Machinery Salesman,
Farm Equipment and Machinery Salesman.

Job Description:

An individual in this occupation must have a good knowledge of the types of farming and ranching most common locally and the farm power and equipment needs of the farmers and ranchers; they must get along well with customers; know equipment on hand for sale, its price, time required for replacement and source; can appraise value of used equipment; know methods of financing; can determine customers ability to pay; can operate and demonstrate machinery their business offers for sale; possesses knowledge of competition's equipment; can estimate reasonably accurate future demands for farm equipment locally; is usually employed by owner of the business.

Competencies Identified and Validated

N = 41*		Weighted Mean**
Competencies		
1.	Have a good knowledge of farming or ranching.	<u>2.8</u>
a.	Know the power and farm equipment needs of local farmers and ranchers to successfully produce crops or livestock.	3.3
b.	Be able to identify equipment problems of local farmers and ranchers.	2.9
c.	Have an acquaintance of many local farmers or ranchers.	2.7
d.	Understand ethnic groups in farming and ranching, (example - Amish, etc.).	2.2
2.	Possess desirable personal qualities and qualifications.	<u>3.4</u>
a.	Be honest and sincere.	3.8
b.	Demonstrate the ability to get along with others.	3.7
c.	Demonstrate a willingness to work.	3.6
d.	Demonstrate a positive job attitude about the organization when working with fellow employees, potential customers, and customers.	3.6
e.	Demonstrate the ability to project a desirable image for the firm.	3.5

* Responses from 41 Farm Equipment Salesmen and their Work Supervisors in 9 states. Survey conducted by the Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

f.	Demonstrate the ability to work on their own.	3.5
g.	Maintain a satisfactory attendance record.	3.4
h.	Demonstrate a willingness to learn or take supervision.	3.4
i.	Budget time wisely.	3.3
j.	Demonstrate the ability to follow directions of supervisor.	3.2
k.	Demonstrate acceptable personal appearance and personal hygiene.	3.2
l.	Accept routine tasks without becoming disinterested.	3.0
3.	Practice good human relations.	<u>3.4</u>
a.	Keep customer's financial records confidential.	3.6
b.	Be a good listener.	3.4
c.	See and report the customer's point of view.	3.1
4.	Develop skill in salesmanship and selling.	<u>3.2</u>
a.	Match customer's real and perceived needs with resources available within the dealership.	3.3
b.	Identify customer's perceived needs.	3.2
c.	Identify customer's real needs.	3.2
d.	Counsel with customer relative to perceived and real needs in a positive and helpful manner.	3.2
e.	Demonstrate the techniques of successful farm and ranch calls.	3.1
f.	Demonstrate the use of different types of sales techniques (phone, face-to-face).	3.0
5.	Know ways farm equipment can be financed.	<u>2.7</u>
a.	Evaluate customer risk and ability to pay.	2.9
b.	Interpret the financial statement of a customer.	2.8
c.	Understand taxes and tax advantages.	2.8
d.	Compute the cost of granting credit.	2.7
e.	Identify and recommend sources of credit available in the community.	2.6
6.	Accurately appraise value of used equipment.	<u>3.1</u>
a.	Be reasonably accurate of re-sale value and market.	3.3
b.	Recognize needed repairs of used equipment and costs to recondition it.	3.1
c.	Know mark-up of new equipment over cost.	3.0
d.	Determine if used equipment had good or poor maintenance by owner.	2.9

7.	Have knowledge of equipment on hand and sources of a re-supply.	<u>2.8</u>
a.	Know where equipment for sale is located or stored in the business.	3.3
b.	Know time required for stock replacement.	2.6
c.	Know sources for re-ordering stock.	2.5
8.	Operate properly the equipment offered for sale.	<u>3.1</u>
a.	Know proper operation/adjustment of equipment.	3.1
b.	Demonstrate equipment operation, adjustment, and maintenance.	3.1
9.	Estimate reasonably close future market for farm equipment.	<u>2.9</u>
a.	Know items in greatest demand.	3.0
b.	Be sensitive to market trends.	2.9
10.	Have good knowledge of competition's equipment.	<u>2.6</u>
a.	Know their strong and weak points.	3.1
b.	Know prices of competitor's equipment.	2.5
c.	Have general knowledge of their equipment inventories.	2.2
11.	Know how to effectively advertise and promote the sale of equipment.	<u>2.3</u>
a.	Identify potential customers from market studies.	2.4
b.	Organize and conduct sales meetings.	2.3
c.	Develop displays.	2.3
d.	Prepare advertising for newspapers, radio, and television.	2.0

IRRIGATION TECHNICIAN

Other Titles: Ditch Tender, Irrigator-Sprinkler System, Irrigator-Stand Pipe, Irrigator - Valve Pipe, Ditch Rider.

Job Description:

Inspects area irrigated to insure adequate soaking and prevent waste of water. Opens head gate to permit entry of water into main ditches. Directs workers in cleaning and repairing ditches. Lays out and connects pipe along designated pipeline settings in the field. Operates revolving sprinklers in the field. Operates pumping system to irrigate crops. Observes revolving sprinklers to insure uniform distribution of water to all areas. Attaches vertical pipes to underground pipeline system to irrigate crops. Observes rate of flow and adjusts valves accordingly. Shovels soil into holes and low spots in levees and removes obstructions. Digs opening in embankment at end of row to direct overflow of water into spillway. Builds levees to prevent water from overflowing other crops or highways. Lubricates pumping equipment and makes minor repairs. Records daily weather data. Accurately takes soil moisture tests, and has a knowledge of crops and their moisture requirements.

Competencies Identified and Validated

N = 62*		Weighted Mean**
<u>Competencies</u>		
1.	Operate sprinkler system.	<u>3.3</u>
a.	Operate sprinkler system for a specified time.	3.6
b.	Adjust continuously operating irrigation system to correct pressure for every location.	3.3
c.	Turn valves.	3.2
d.	Check gauges.	3.2
e.	Change valves.	3.2
2.	Perform maintenance activities.	<u>3.2</u>
a.	Replace broken pipe.	3.4
b.	Clean sprinklers.	3.3
c.	Repair broken valves.	3.3
d.	Dig up and repair underground valves.	3.3

* Responses from 62 Irrigation Technicians in 30 states. Survey conducted by Department of Agricultural Education, California Polytechnic State University, San Luis Obispo, California 93401.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

e.	Repair stabilizers.	3.2
f.	Disassemble sprinkler systems.	3.1
3.	Lay out sprinkler systems.	<u>3.1</u>
a.	Assemble and maintain piping systems and fixtures.	3.2
b.	Install sprinkler heads.	3.2
c.	Inspect line for leaks.	3.0
d.	Design and install irrigation equipment in new areas.	2.9
4.	Distribute water into irrigation system.	<u>2.9</u>
a.	Regulate irrigation system to convey water to farms in assigned area.	3.5
b.	Contact water users to determine quantity of water needed, and time and duration of delivery.	2.9
c.	Operate gates, checks and turnouts to regulate waterflow into canals and laterals.	2.8
d.	Calculate and record quantities of water delivered for use in computing charges to farmers.	2.6
5.	Patrol and inspect irrigation system.	<u>2.8</u>
a.	Supervise crew workers cleaning ditches, raising ditch banks, repairing concrete and wooden structures, and erecting fences and gates.	3.1
b.	Fill holes and exterminate rodents.	3.0
c.	Patrol assigned area by foot, horseback, or motor vehicle to detect leaks, breaks, weak areas, obstructions, and damage to irrigation systems.	2.9
d.	Remove debris and make emergency repairs to banks, structures, gates, and canal roads.	2.9
e.	Prepare reports on condition of system and equipment, and replacements or repairs needed.	2.5
f.	Patrol canal at night to determine that water is flowing in prescribed volume into users ditches.	2.2
6.	Provide data for irrigation system.	<u>2.6</u>
a.	Recognize specific growth stage of crops and their irrigation requirements.	3.0
b.	Check soil moisture conditions.	3.0
c.	Record and plot daily weather data and keep in adjustment all instruments at the climatic stations.	2.6

- d. Obtain information on wind and rainfall conditions. 2.4
- e. Change weekly weather charts. 2.2
- 7. Operate irrigation pumps. 2.4
 - a. Perform maintenance activities in the pumping plant. 2.7
 - b. Select correct motor for type of pump. 2.2
 - c. Repair and adjust motors. 2.2

PLANT ELECTRICIAN

(Fruit and Vegetable Processing Industry)

Other Titles: Maintenance Electrician, Operation Engineer, Mechanic I - Electrician.

Job Description:

The Plant Electrician has full responsibility for the operation, maintenance, efficiency, and safety of all plant electrical circuits and electrical equipment. May supervise helpers and/or personally maintain and install wiring, motors, switch panels, fuse boxes, lighting, heating, cooling equipment. Reads and interprets blue prints and circuit diagrams; inspects all electrical equipment, connects, adjusts, and calibrates electrical gauges and recording instruments. Makes running repairs and corrections, and requisitions parts and materials in response to plant needs.

Competencies Identified and Validated

N = 27*

Competencies	Weighted Means**
1. Personal traits and attitudes.	
a. Electrical aptitude.	3.9
b. Safety-oriented (concerned for safety).	3.9
c. "Knack" for trouble shooting.	3.6
d. Mechanical aptitude.	3.6
e. Initiative to work independently.	3.5
f. Cooperative with others.	3.4
g. Plan ahead.	3.4
h. Can be supervisory.	2.7
2. Skill and ability of the Plant Electrician.	
a. Wire fuse boxes.	4.0
b. Determine correct wire capacities.	4.0
c. Choose correct wire sizes.	3.8
d. Wire lighting fixtures and apparatus.	3.8
e. Wire switch panels.	3.8
f. Read and interpret written instructions.	3.8
g. Interpret verbal instructions.	3.8
h. Wire motors.	3.6
i. Install conduit.	3.6
j. Install motors.	3.5

* Responses from 27 Fruit and Vegetable Processing Plant Electricians throughout the United States. Survey conducted by the Agricultural Education Unit, Department of Applied Behavioral Sciences, University of California, Davis, California 95616.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

k.	Evaluate power circuit problems.	3.5
l.	Read and understand circuit diagrams.	3.5
m.	Read and understand blueprints.	3.4
n.	Repair switch panels.	3.4
o.	Install control transformers.	3.0
p.	Design wiring systems.	2.9
q.	Anticipate future materials needed.	2.9
r.	Choose correct transformers to carry needed loads.	2.9
s.	Keep maintenance records on instruments.	2.7
t.	Repair motors.	2.7
u.	Requisition materials and parts.	2.6
v.	Install high voltage transformers.	2.5
w.	Repair fans.	2.5
x.	Overhaul controls and related instruments.	2.5
y.	Maintain and repair heating systems.	2.4
z.	Maintain and repair cooling systems.	2.4
aa.	Maintain and repair packaging equipment.	2.3
bb.	Supervise crews.	2.1
cc.	Use charts and conversion tables.	2.1
dd.	Maintain and repair fire control equipment.	2.0
ee.	Repair warehouse equipment.	2.0
ff.	Repair control transformers.	1.9
gg.	Repair electrical problems of lift-trucks, clamps, and pull-pacs machinery.	1.9
hh.	Repair refrigeration unit.	1.7
ii.	Repair conveyors.	1.7
jj.	Install refrigeration units.	1.6
kk.	Repair high voltage transformers.	1.5
ll.	Repair freight elevator.	1.4
mm.	Repair ignition and electrical systems of automotive equipment.	1.4
3.	Concepts and facts that the plant electrician should know.	
a.	Electrical code-OSHA.	3.7
b.	English language.	3.5
c.	Basic standard electrical formulas.	3.4
d.	Electronics.	2.9
e.	Algebra.	2.1
f.	Physics.	2.0
g.	Geometry.	1.8
h.	Trigonometry.	1.8
i.	Calculus.	1.7

LIFT TRUCK OPERATOR

(Fruit and Vegetable Processing Industry)

Other Titles: Hyster Driver, Jeep Driver,
Shipper, Forklift Operator, Clamp Operator,
4-hi Stacker, Car Loader, Receiver.

Job Description:

Selects stock in accordance with shipping documents and delivers them to the proper plant location. Examples of stock shipped are pallets, containers, and boxes. May load and unload highway trucks and railroad cars; stack and unstack pallets. Will maintain gas, oil, and water supply of lift trucks. Reports irregularities in operation. May be trained to use clamp, and pull-pack machinery.

Competencies Identified and Validated

N = 26*

Competencies	Weighted Means**
1. Attitudes and personal traits.	
a. Good motor coordination.	3.9
b. Good visual perception.	3.9
c. Be cautious.	3.8
d. Good spatial perception.	3.7
e. Be orderly.	3.6
f. Good hearing.	3.5
g. Be efficient.	3.3
h. Be helpful.	3.1
i. Be cooperative.	3.2
2. Skills and abilities of the Fork Lift Operator.	
a. Tilt load backwards before travelling.	3.9
b. Work safely in confined quarters.	3.7
c. Center load on forks at first approach.	3.6
d. Pick up and set down pallets.	3.6
e. Pass lift truck driving test.	3.5
f. Pick up and set down skids.	3.5
g. Pick up and set down cases.	3.5
h. Keep forks level and clear of floor.	3.5
i. Stack materials closely.	3.5
j. Drive smoothly without shaking loads.	3.4

* Responses from 26 Fruit and Vegetable Processing Plant Lift Truck Operators throughout the United States. Survey conducted by the Agricultural Education Unit, Department of Applied Behavioral Sciences, University of California, Davis, California 95616.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

k.	Read manifest.	3.3
l.	Fill gas, change oil, and check water in lift trucks.	3.2
m.	Turn sharp corners.	3.2
n.	Drive backwards down ramps.	3.1
o.	Use inching pedal.	2.9
p.	Figure rated capacity of lift truck.	2.8
q.	Work under close supervision.	2.6
r.	Stack materials into railroad cars.	2.6
s.	Drive clamp truck.	1.7
t.	Drive pull-pack truck.	1.6
u.	Cross railroad tracks.	1.6
v.	Change batteries in electric lift trucks.	1.5
w.	Give hand signals for stopping and starting.	1.3
3.	Facts and concepts.	
a.	Aware of plant safety rules and signs.	3.8
b.	Aware of driving responsibility.	3.7
c.	Aware of plant speed limits.	3.5
d.	Have knowledge of running condition of lift truck.	3.2
e.	Aware of OSHA operating standards.	3.2
f.	Perform simple mathematical functions.	3.0
g.	Have mechanical knowledge of forklift truck.	2.1
h.	Have knowledge of electrical system.	1.7

INSTRUMENT TECHNICIAN

(Fruit and Vegetable Processing Industry)

Other Titles: Electronic Technician, Mechanic I -
Instrumentation.Job Description:

Maintains and repairs plant electronic and pneumatic instruments and meters. Overhauls processing instruments, controls, and related instruments. May test, time, and calibrate instruments for efficient performance. Keeps maintenance records, reads blue prints, charts, diagrams and operating instructions on instruments. Reads pneumatic circuit layouts and installation diagrams, makes proper use of all precision measuring instruments, and other special tools and equipment.

Competencies Identified and Validated

N = 16*

Weighted
Means**Competencies

1. Attitudes and personal traits.	
a. Precise.	3.6
b. Mechanical and electrical aptitude.	3.5
c. Reliable.	3.4
d. Prompt/punctual.	2.9
e. Fine manual dexterity.	2.3
2. Skills and abilities of the Instrument Technician.	
a. Install and repair pneumatic instruments.	3.7
b. Operate, repair and calibrate temperature controller recorders.	3.7
c. Install and repair control piping.	3.3
d. Understand theory and work with steam distribution and controls.	3.2
e. Work with transmitters.	3.1
f. Install control valves.	3.1
g. Work with receivers.	3.0
h. Understand theory and work with temperature transfer systems.	3.0
i. Utilize thermisters.	2.9
j. Utilize soft solder for installation and repairs.	2.9

* Responses from 16 Fruit and Vegetable Processing Plant Instrument Technicians throughout the United States. Survey conducted by the Agricultural Education Unit, Department of Applied Behavioral Sciences, University of California, Davis, California 95616.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

k.	Understand theory and work with hot water systems.	2.8
l.	Understand theory and work with cold water systems.	2.8
m.	Operate hand drill.	2.7
n.	Operate oscilloscope.	2.5
o.	Repair and maintain servomotors.	2.4
p.	Operate voltmeters.	2.4
q.	Utilize silver solder for installation and repairs.	2.4
r.	Braze.	2.1
s.	Operate drill press.	2.1
t.	Operate power hack saw and grinder.	2.1
u.	Obtain license to operate Hilti power tools.	1.1
v.	Operate turret lathe.	0.9
3.	Have basic knowledge of facts and concepts.	
a.	English language.	3.4
b.	Electronics.	2.8
c.	Algebra.	2.1
d.	Geometry.	1.9
e.	Trigonometry.	1.8
f.	Computers.	1.2

LABORATORY TECHNICIAN

(Fruit and Vegetable Processing Industry)

Other Titles: Quality Control Club/Technician,
Process Grader, Process Checker, Food Technologist,
Microanalytical Technician.

Job Description:

Tests product during processing procedure and finished product using standardize laboratory procedures to insure that the product meets quality control standards. Evaluates and records the quality of the finished product for consistency and other factors which distinguish the product quality as acceptable for consumption.

Competencies Identified and Validated

N = 25*

Competencies	Weighted Means**
1. Attitudes and personal traits.	
a. Be able to follow instructions from supervisor.	3.9
b. Be correct, complete, and thorough in recording data.	3.9
c. Maintain an attitude of pride and concern regarding quality of work.	3.7
d. Be safety conscious and practice safe laboratory techniques.	3.6
e. Get along with and work cooperatively with fellow employees.	3.2
2. Skills and abilities.	
a. Utilize and read a thermometer.	3.6
b. Operate and read an over and under scale.	3.5
c. Use chlorine testers.	3.2
d. Know and perform sample preparation techniques.	3.2
e. Check and record net or drain weights.	3.2
f. Use pH meters to check acidity.	3.1
g. Grade for defects in product.	3.1
h. Read a refractometer to check solids.	3.0
i. Perform simple titrations to check salt and acid levels in the product.	2.9
j. Must be able to stand long period of time.	2.9

* Responses from 25 Fruit and Vegetable Processing Plant Laboratory Technicians throughout the United States. Survey conducted by the Agricultural Education Unit, Department of Applied Behavioral Sciences, University of California, Davis, California 95616.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

k.	Make dilutions.	2.8
l.	Operate a microscope.	2.7
m.	Make and record mold counts.	2.7
n.	Make and record insect counts.	2.7
o.	Recognize visual defects in packaging.	2.7
p.	Use consistometer to measure consistency.	2.4
q.	Determine moisture content of product.	2.3
r.	Operate and read a shadowgraph scale.	2.2
s.	Use pH indicators to check acidity.	2.2
t.	Operate a stereoscope to check for insect fragments, etc.	2.1
u.	Use a colorimeter.	2.0
v.	Use an analytical balance.	2.0
w.	Identify insects by fragment contamination.	1.9
x.	Operate an ultra centrifuge.	1.9
y.	Use flow tubes to check viscosity.	1.8
z.	Utilize hydrometer to check specific gravities.	1.7
aa.	Use a micrometer to measure can seams.	1.5
bb.	Know tear-down techniques.	1.3
cc.	Use dial calipers to measure can seams.	1.2
dd.	Use a seam scope and projector.	1.0
ee.	Operate tenderometer.	1.0
3.	Facts and concepts.	
a.	Read and write English.	3.9
b.	Make subjective evaluations of character, flavor, texture, color, and odor of finished product.	3.4
c.	Record data on charts and understand results or implications.	3.4
d.	Have a knowledge of basic mathematics including negative numbers.	3.2
e.	Understand terminology (i.e., "smoothness," "contour," etc.)	2.5
f.	Have a basic knowledge of chemistry.	2.4
g.	Have a basic knowledge of biology.	1.8

PLANT MAINTENANCE MECHANIC

(Fruit and Vegetable Processing Industry)

Other Titles: General Mechanic, Maintenance
Journeyman, Department Mechanic, Plant Engineer.

Job Description:

Installs, assembles, maintains, and overhauls plant machinery and equipment. Reads sketches, prints, and operating instructions and determines procedures. Checks materials and parts and makes requisitions. Tests, times and adjusts machinery and equipment. Operates various hand tools and equipment including welding equipment. May direct mechanical and maintenance crews.

Competencies Identified and Validated

N = 29*

Competencies	Weighted Means**
1. Attitudes and personal traits.	
a. Be safety conscious and practice safe mechanical procedures.	3.8
b. Must be mechanically inclined.	3.7
c. Must be careful and conscientious.	3.7
d. Be able to communicate with co-workers.	3.6
e. Must be physically capable of performing light to hard manual labor.	3.5
f. Be able to correctly diagnose mechanical failures or troubleshoot.	3.4
g. Be able to work in high tension and stressful situations.	3.3
h. Be able to organize and direct helpers.	3.0
2. Skills and abilities.	
a. Change bearings.	3.6
b. Change sprockets.	3.6
c. Tighten belts.	3.6
d. Perform emergency repairs.	3.6
e. Be able to operate a drill press.	3.6
f. Be able to operate a cutting torch.	3.5
g. Install pulleys.	3.5
h. Lace belts.	3.5
i. Repair link chains.	3.5

* Responses from 29 Fruit and Vegetable Processing Plant Maintenance Mechanics throughout the United States. Survey conducted by the Agricultural Education Unit, Department of Applied Behavioral Sciences, University of California, Davis, California 95616.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

j.	Install safety guards and braces.	3.5
k.	Tear down and reassemble machinery and equipment.	3.5
l.	Be able to operate an electric arc welder.	3.4
m.	Be able to operate an oxy-acetylene welder.	3.4
n.	Be able to operate a brazing torch.	3.4
o.	Fabricate materials for mounts.	3.4
p.	Pack bearings.	3.4
q.	Test and time machinery.	3.4
r.	Be able to operate a stainless steel welder.	3.1
s.	Be able to operate a micrometer.	3.0
t.	Read gauges on micrometers and other precision tools.	3.0
u.	Maintain and repair hydraulic systems.	3.0
v.	Maintain and repair pneumatic systems.	3.0
w.	Be able to operate a heliarch welder.	2.9
x.	Maintain and repair centrifugal and positive displacement pumps.	2.9
y.	Can do sheet metal work.	2.7
z.	Be able to operate a surface grinder.	2.6
aa.	Be responsible for plumbing, maintenance and repair.	2.5
bb.	Keep accurate records.	2.2
cc.	Make parts requisitions.	2.2
dd.	Be able to operate a jack hammer.	2.0
ee.	Keep accurate time cards.	2.0
ff.	Be able to operate a milling machine.	1.9
gg.	Be responsible for painting procedures.	1.8
hh.	Perform necessary carpentry functions.	1.8
ii.	Keep accurate inventories.	1.8
jj.	Perform electrical maintenance and repair procedures.	1.7
kk.	Perform concrete work.	1.7
ll.	Be able to operate a shaper.	1.6
mm.	Be able to operate a turret lathe.	1.5
nn.	Make automotive repairs.	1.5
oo.	Keep accurate cost sheets.	1.2
3.	Concepts and Facts.	
a.	Be able to read and write English.	3.6
b.	Have knowledge of OSHA standards.	3.1
c.	Have basic understanding of mathematics.	3.1
d.	Know where to obtain current OSHA standards.	2.9
e.	Have knowledge of current FDA standards.	2.7
f.	Understand operating principles of centrifugal and positive displacement pumps.	2.7
g.	Have a basic understanding of the principles of engine operation.	2.4
h.	Have knowledge of metal stresses and fatigues.	2.3
i.	Have an understanding of temperatures and indicators of temperature (i.e., color of heating metal, thermometers).	2.2
j.	Have a basic understanding of electrolysis.	1.7